EXPANDED SITE INSPECTION/
GROUNDWATER PATHWAY ASSESSMENT
FOR
HANNAH MARINE CORP
LEMONT, ILLINOIS
U.S. EPA ID: ILD069496248
SS ID: NONE
TDD: F05-8810-002
PAN: FIL0277XB

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SIGNATURE PAGE
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1. INTRODUCTION

The Hannah Marine Corp (HM) site is an active 97-acre facility with 30 employees. The facility is designed to support the transport of bulk liquid chemicals by barge. Operations at the facility include repairing and cleaning barges. Waste chemicals, which are vacuumed from the barges during cleaning, and wastewater are currently stored in tanks at the site. Formerly, they were dumped directly into an adjacent shipping canal or stored in open lagoons (E & E 1986).

The date of the site discovery is not known, but the first significant legal activity concerning the site occurred in November 1979, when the Metropolitan Sanitary District of Greater Chicago (MSD), a division of Cook County, the lessor of the land, served an eviction notice to Hannah Marine Corporation, the site operator. This notice stipulated that two storage lagoons on the site could no longer be used for the storage of wastewater and chemicals (Schroeder 1979).

The site was evaluated in the form of a preliminary assessment (PA) that was submitted to the United States Environmental Protection Agency (U.S. EPA). The PA was prepared by Jim Wiggins of the Illinois Environmental Protection Agency (IEPA) and is dated March 29, 1984 (U.S. EPA 1984).

On May 8, 1985, Ecology and Environment, Inc. (E & E), Field Investigation Team (FIT) conducted a screening site inspection (SSI) of the HM site. As a result of this inspection, E & E FIT was tasked by U.S. EPA to conduct an expanded site inspection/groundwater pathway assessment (ESI/GPA) under technical directive document (TDD) F05-8810-002, issued on October 6, 1988. The general objectives of the ESI/GPA

were to determine the effect of the site on local groundwater quality, to prepare a hydrogeologic report, and to collect data to meet Hazard Ranking System (HRS) scoring criteria. Specific objectives to accomplish this task include the following.

- To install and develop six monitoring wells, including an upgradient well.

- To identify groundwater characteristics and to determine groundwater flow gradients.

- To determine whether an observed release of hazardous substances to groundwater has occurred.

- To further determine waste characteristics of soil in order to provide areal extent for HRS scoring.

2. SITE BACKGROUND

2.1 SITE DESCRIPTION

The HM site is a 97-acre parcel of land that is located in unincorporated Lemont, Illinois, in portions of both Cook and DuPage counties (N1/2 sec. 14, T.37N., R.11E.). The site is situated on a point of land that lies at the confluence of the Chicago Sanitary and Ship Canal (SSC) and the Calumet-Sag Channel (CSC). The abandoned Illinois and Michigan Canal, trending east and west, divides the 97-acre site into a northern portion and a southern portion. The site is bordered by the SSC on the northwest, the Illinois Central Gulf Railroad on the southeast, State Route 83 on the east, and the CSC on the south. The Des Plaines River is located approximately 1,000 feet northwest of the site (see Figure 2-1 for site location).

The HM site is currently active in support operations for the transport of bulk liquid chemicals and petroleum products by barge (U.S. EPA 1980). Operations at the site include a barge repair and cleaning shop with docks on the south side of the SSC (E & E 1986) (see Figure 2-2 for site features).

An office building is located in the northern portion of the site. The barge repair shop is located approximately 100 feet east of the office building. Wastewater from the barge cleaning operations is stored in an aboveground tank farm approximately 100 feet east of the repair shop. The tank farm consists of a primary 436,000-gallon water tank that is enclosed by an approximately 160-foot by 150-foot earthen berm. The berm is approximately 4 feet thick and 4 feet high. Two smaller 60,000- gallon tanks lie approximately 10 feet east and west of

FIGURE 2-1

FIGURE 2-2

the primary water tank and contain waste oil and gasoline. A row of vacuum tanks and fuel oil and gasoline storage tanks lies approximately 50 feet north of the bermed area. A pump house is located approximately 25 feet east of this row of tanks.

The site is accessed by a gravel road that turns off of Archer Avenue at the southeastern edge of the site. This access road extends along the western boundary of the site and enters a parking lot that is located west of the office building. Smaller access roads and gravel parking lots and maneuvering areas surround the tank farm and other site structures.

FIT photographs from the ESI/GPA of the HM site are provided in Appendix A.

2.2 SITE HISTORY

The HM site is located on property owned by the Metropolitan Water Reclamation District (MWRD) and leased to Hannah Marine Corporation (Barnas 1989). Until 1990, MWRD was identified as MSD (Sustich 1991). The site is an active facility that began operations in 1951 (Barnas 1989). The nature of site operations before 1951 is not known, although it is presumed that the property was undeveloped prior to this time.

Hannah Marine Corporation functions primarily to support the transport of bulk liquid chemicals and petroleum products by barge (Wiggins 1984). Hannah Marine also operates a barge repair and cleaning shop (Wiggins 1984; E & E 1986). In its cleaning operations, Hannah Marine vacuums storage compartments of barges to remove the remaining chemical products (E & E 1986). Occasionally, the storage compartments are steam-cleaned with a detergent to remove chemical residues from the walls and floors. The amount of wastewater and sludge generated from the cleaning of a single barge varies from 9,000 to 15,000 gallons, with approximately 90 to 120 barges being cleaned per year (E & E 1986).

During the period from 1951 to 1958, wastes generated from the cleaning operation were discharged directly into the SSC (E & E 1986). This method of disposal was discontinued in 1958 at the insistence of MSD. In late 1958, two unlined retention lagoons were constructed on-site to store the cleaning wastes (see Figure 2-3 for site conditions, 1961, showing an aerial photograph of the HM site and location of one

FIGURE 2-3

lagoon). Another lagoon is believed to have been located at the far western edge of the site, in the vicinity of an ongoing construction project (Sustich 1991a). The storage tank farm was built in the area of the first lagoon sometime after 1974 (see Figure 2-4 for site conditions, 1974, showing an aerial photograph of the HM site and location of the storage tank farm). The lagoons were used until 1978, when MSD insisted that they be filled. At this time, MSD constructed two groundwater sampling sumps (E & E 1986).

In November 1979, MSD prepared a 60-day eviction notice to be served to Hannah Marine Corporation unless it complied with specific provisions prepared by MSD (Schroeder 1979). The provisions stipulated that Hannah Marine obtain a proper holding tank for liquid wastes, dike the liquid wastes present in the lagoons on-site, and comply with demands made by IEPA for cleanup procedures and future handling of wastes (Schroeder 1979).

On November 16, 1979, MSD, U.S. EPA, and IEPA met with Hannah Marine to discuss the progress of cleanup procedures at the site (Schroeder 1979). During the discussion, it was determined that approximately 5,000 gallons of wastewater from the lagoons had been pumped out and disposed of at the Winthrop Harbor disposal facility, approximately 55 miles north of the site. Also, the on-site lagoons had been diked, as requested by MSD (Schroeder 1979).

In November 1980, Hannah Marine filed an application with U.S. EPA for a Hazardous Waste Permit (U.S. EPA 1980). With the application, Hannah Marine supplied a diagram of the facility showing a tank labeled "waste oil" and another tank labeled "contaminated water." These tanks were located in the diked area formerly occupied by the lagoons (U.S. EPA 1980). The exact date of their placement on-site is not known, but apparently the tanks had been placed there for waste storage after the lagoons were diked and filled.

On April 9, 1982, a representative from IEPA conducted an inspection of the HM site to determine compliance with the Resource Conservation and Recovery Act (RCRA) (Bechely 1982). During the inspection, several deficiencies in compliance with RCRA were noted. The deficiencies included a lack of chemical and physical analysis of stored wastes; a lack of detailed information on the types and quantities of

FIGURE 2-4

wastes generated; and a lack of information on the subsequent treatment, storage, and disposal of wastes. Hannah Marine was ordered by IEPA to rectify the deficiencies or face possible enforcement action by U.S. EPA (Bechely 1982). Hannah Marine complied with the IEPA request in July 1982 by supplying the agency with the appropriate documentation (Lambert 1982).

Lack of information concerning the cleanup procedures as a follow-up to the removal of the lagoons prompted IEPA to perform a Potential Hazardous Waste Site PA on March 29, 1984 (E & E 1991). As a result of the findings of the PA, E & E FIT conducted a screening site inspection (SSI) at the HM site. The SSI, conducted on May 8, 1985, included a reconnaissance inspection and the collection of three on-site groundwater samples, three sediment samples, and one wastewater sample from an aboveground storage tank. During the SSI, FIT noted that the material vacuumed from barges was stored separately from the wastewater. The vacuumed material was stored in an aboveground tank farm near the on-site office building, while the wastewater was stored in the tank in the area of the former lagoons. The contents of the waste storage tanks were being shipped to the Chem Clean Company in East Chicago, Indiana, for disposal. Wastes were shipped two to three times per year. FIT also observed that the diking around the wastewater tanks was in poor condition and that no diking was present around the waste storage tanks (E & E 1986).

Chemical analysis results of the FIT-collected on-site samples indicated the presence of several U.S. EPA Target Compound List (TCL) compounds, including chloromethane (118.7 mg/kg), vinyl chloride (296 µg/L), chloroethane (271 µg/L), 1,1-dichloroethane (1,360 µg/L), 1,1,1-trichloroethane (1,090 µg/L), and toluene (172,264 mg/kg) (E & E 1986) (see Figure 2-5 for areas of contamination identified during the SSI).

On July 17, 1987, IEPA conducted a RCRA site inspection at the HM site (IEPA 1987). During the inspection, IEPA noted several apparent violations, including improper labeling of hazardous waste storage tanks and the lack of a description in Hannah Marine's 1986 annual report concerning efforts to reduce the volume and toxicity of wastes generated at the site. Hannah Marine Corporation was informed by IEPA of the violations on August 31, 1987, and given 15 days to respond (Kissinger 1987).

FIGURE 2-5

Hannah Marine responded in September 1987 by providing the information that IEPA had requested (Rosemarin 1987). Upon reviewing the information provided by Hannah Marine, IEPA then determined that the previous violations had been resolved (Chappel 1987).

In 1990, a construction crew was contracted by MWRD to excavate a pit near the site for a water diversion system (Kelley 1991). The pit was located approximately 75 feet north of the CSC and west of the junction of Archer Avenue and State Route 83, which is located immediately to the southeast of the site. The construction crew noticed a heavy oil, presumed to be #5 or #6, coming to the surface from the pit. The construction crew performed a leachate test and determined that the oil was nonhazardous. They removed the oil and proceeded with the excavation. Frank Kelley, an engineer from the Industrial Waste Division of MWRD, also collected a sample of the waste (Sustich 1991b). The results of the analysis of the sample collected by Kelley are not known. Kelley alleges that the oil came from the HM site (Kelley 1991).

No other known regulatory, enforcement, or remedial action is known to have occurred at the HM site.

2.3 REGIONAL GEOGRAPHY

Physiography. The area around the HM site comprises the Wheaton Morainal Country of the Great Lakes Section of the Central Lowland Province. The HM site lies near the western edge of the Wheaton Morainal Country in a flat, low-lying valley created by an outlet from glacial Lake Chicago. This valley is now part of the channel of the present-day Des Plaines River (Willman 1971). The 97-acre site is located on a point of land at the confluence of the SSC and the CSC. The site lies at an elevation of approximately 600 feet above mean sea level (MSL) and, as a result of extensive engineering of the surrounding waterways, is generally flat (E & E 1986).

Hills that rise above the valley represent the effects of continental glaciation and were formed as kames, kame terraces, eskers, and end moraines. In some areas near the site, portions of Silurian reefs protrude through this glacial cover. The present-day topography of the surrounding hills has resulted from dissection of the glacial features by existing streams and rivers (Willman 1971).

The HM site lies near the major drainage divide that separates waters that flow to the Gulf of St. Lawrence through the Great Lakes and those that flow to the Gulf of Mexico through the Illinois and Mississippi rivers (Willman 1971). The Des Plaines River, which flows southwest, drains the southeastern portion of DuPage County. Much of Cook County was formerly drained toward Lake Michigan through the Chicago and Calumet rivers. Construction of locks along these rivers, however, has reversed their flows, and they now flow into the Des Plaines River through the SSC and the CSC. The Des Plaines River, therefore, is now the major drainage for DuPage and Cook counties. Some areas near the site, such as sloughs, bogs, and kettles, are essentially undrained (U.S. Department of Agriculture [USDA] 1979).

Principal soils in the site area are mapped as Romeo silt loam, which consists of an approximately 5-inch layer of loam overlying carbonate bedrock, and Orthents stony. Orthents stony consists of stones and boulders that have been dredged from the underlying carbonate regolith or blasted from the bedrock during the construction of nearby waterways.

Climate. The climate in the area of the site is temperate cold and dry in the winter and hot and humid in the summer. The mean temperature is 21.1° F in January and 72.2° F in July. The mean annual precipitation, which is well-distributed throughout the year, is 33.42 inches. The average seasonal snowfall is 38.3 inches. The lowest monthly precipitation, 1.24 inches, occurs in February, and the highest, 4.04 inches, occurs in September.

These data, which reflect conditions in Chicago, were prepared by the National Climatic Center in Asheville, North Carolina, for the Soil Conservation Service (USDA 1979). Prevailing winds in the area are westerly at 11 miles per hour in January and southwesterly at 8 miles per hour in July (U.S. Department of Commerce 1979).

Demographics. The HM site is located in an unincorporated area of the city of Lemont, a primarily residential rural community with a population of approximately 4,600 persons. Most of the city's residents live in old residential neighborhoods in the city's center, which lies approximately 3 miles southwest of the HM site (Guizzon 1991). In 1980,

there were 2,256 persons per square mile in the city of Lemont (U.S. Bureau of the Census 1982).

Land Use. The HM site lies in a primarily commercial/industrial and recreational area of unincorporated Lemont. Forested land surrounds the residential areas of Lemont and Downers Grove, and is the most dominant landscape in the site area. Much of the forested land is maintained as forest preserves and parks (United States Geological Survey [USGS] 1962, 1963, 1963a, 1963b). Agriculture is limited to only small areas around the site.

The Argonne National Laboratory reservation is a 1,700-acre multidisciplinary research facility that lies approximately 1/2 mile northwest of the HM site. Approximately 50 laboratories and administrative buildings occupy small portions of the reservation. The remainder of the property is forested land (Foster 1991).

In the immediate site area in the Des Plaines valley, FIT observed several salvage yards and ongoing commercial construction projects.

Waterway Use. The SSC and the CSC are major waterways for barge traffic between inland industries and Chicago area ports along Lake Michigan. All types of manufactured products are transported on the barges, but raw materials, such as chemicals, sand and gravel, coal, petroleum products, and grain, are the largest components of the waterway traffic (Wadleigh 1991).

2.4 REGIONAL GEOLOGY AND HYDROGEOLOGY

The regional geology of the HM site is characterized by mildly deformed Paleozoic sedimentary rocks that are overlain by unconsolidated Quaternary glaciogenic deposits.

The unconsolidated sediments are almost entirely Wisconsinan in age and represent a variety of glacial environments. Till deposits, primarily moraines, are unsorted and range in texture from dense clay-rich material to gravel- and sand-rich material (Zeizel et al. 1962; Willman 1971). In DuPage County, these deposits are expressed as a series of end moraines, trending north and south, which record short and rapid fluctuations of the margin of the Michigan Lobe. These moraines are generally assigned to the Valparaiso Moraine, which is a morphostratigraphic subdivision of the Wedron Formation (Willman 1971).

Glaciofluvial deposits in the region are generally well-sorted bodies of clay, sand, or gravel that are expressed at the surface as kames, kame terraces, and eskers. Some of these features are draped along the slopes of more prominent moraine or bedrock topographic highs. Glaciofluvial sediments are also interbedded with till material as lenticular, discontinuous, and erratically distributed bodies. Some glaciofluvial material is also found as residual valley train deposits in major drainages that have survived to the present day, such as the Des Plaines valley (Zeizel et al. 1962; Willman 1971) (see Figure 2-6 for regional surficial geology of the site area).

The major drainage for glacial Lake Chicago is known as the Chicago outlet. This feature, which was active intermittently throughout much of Wisconsinan time, eroded through previously existing drift to form the Des Plaines valley, which forms the channel of the present-day Des Plaines River. The erosion of the Chicago outlet was so extensive that bedrock has been exposed along some stretches of the Des Plaines valley (Willman 1971).

Regional bedrock consists of a massive sequence of sedimentary rocks that were deposited in the basin and along the margins of a shallow continental sea (Willman 1971) (see Figure 2-7 for a generalized stratigraphic column of the site area).

Silurian rocks form the bedrock surface throughout most of the region. Composed almost exclusively of dolomite, these rocks are divided into series that are separated by minor interruption in sedimentation. The younger Niagaran System consists of three formations. The youngest of these, the Racine Dolomite, is characterized by large reefs of pure dolomite that are flanked by argillaceous and silty dolomite with lenses of green shale. The Waukesha Dolomite is a brownish, slightly silty, fine-grained dolomite that occurs in smooth-surfaced beds. The Joliet Dolomite, the basal formation of the Niagaran System in the region, is characterized by interbedded, red, coarse dolomite and greenish-gray, argillaceous dolomite with green and red shale partings between the beds, light gray to white cherty dolomite, and mottled pink, vuggy pure dolomite (Willman 1971).

The Alexandrian Series of the Silurian System consists of two formations in the region. The Kankakee Dolomite is composed of gray to

FIGURE 2-6

FIGURE 2-7

pinkish-gray or white dolomite. The Edgewood Dolomite is argillaceous, cherty brownish-gray dolomite (Willman 1971).

The Ordovician System in the region comprises 17 formations in 3 series. These formations, from youngest to oldest, are divided into five groups as follows: 1) Maquoketa Group--Neda Formation (oolitic limestone), Brainard Shale, Fort Atkinson Limestone, Scales Shale; 2) Galena Group--Dunleith and Wise Lake formations (limestone and dolomite), Guttenberg Formation (dolomite and limestone); 3) Platteville Group--Nachusa Formation (dolomite and limestone), Grand Detour Formation (limestone and dolomite), Mifflin Formation (limestone and dolomite), Pecatonia Dolomite; 4) Ancell Group--Glenwood Formation (sandstone, dolomite, and shale), St. Peter Sandstone; 5) Prairie du Chien Group--Shakopee Dolomite, New Richmond Sandstone, Oneota Dolomite, Gunter Sandstone (Willman 1971).

The Cambrian System in the region comprises seven formations. These formations, from youngest to oldest, are as follows: Eminence Formation (sandy dolomite), Potosi (Trempeleau) Dolomite, Franconia Formation (dolomite), Ironton Sandstone, Galesville Sandstone, Eau Claire Formation (sandstone), and Mt. Simon Sandstone (Willman 1971).

The bedrock in the region of the HM site lie along the northeastern flank of the Kankakee Arch. This broad, asymmetrical anticline, trending northwest and southeast, is a northwestern extension of the Cincinnati Arch and separates the Michigan and Illinois basins. Dip of the bedrock is less than 1 degree east and southeast.

Hydrogeology. The groundwater system in the region of the HM site consists of six basic geohydrologic units: glacial drift aquifers, Silurian dolomite aquifer, leaky confining beds of the Maquoketa Group, Cambrian-Ordovician aquifer, confining beds of the Eau Claire Formation, and Mt. Simon aquifer.

Sand and gravel of the surficial glacial deposits constitute the Prairie Aquigroup. This aquifer is poorly distributed in the region. Wells that draw from the Prairie Aquigroup in DuPage County range in depth from 61 to 136 feet and produce 20 to 750 gallons per minute (gpm) (Woller, Sanderson, and Sargent 1986; Zeizel et al. 1962).

Silurian Dolomite in the region constitute the shallow Upper Bedrock Aquigroup. Zones of saturation exist primarily in joints and

fractures, which have been enlarged by solutioning, in the eroded surface of the Niagaran Series. Wells that draw from the shallow Upper Bedrock Aquigroup in DuPage County range in depth from 75 to 425 feet and produce from 200 to 2,500 gpm (Woller, Sanderson, and Sargent 1986; Zeizel et al. 1962).

Relatively impermeable shale beds of the Maquoketa Group underlie the Silurian Dolomite. These beds allow leakage from the Silurian Dolomite into the underlying units (Woller, Sanderson, and Sargent 1986; Zeizel et al. 1962).

The Cambrian-Ordovician, or the Midwest Aquigroup, underlies the Maquoketa Group. Small yields are obtained from joints and fractures in the Galena and Platteville groups and the Prairie du Chien Group, and from poorly indurated zones of the Glenwood and St. Peter sandstones. The main producing formations of this aquifer are the Ironton and Galesville sandstones, which are consistently permeable, clean, and friable. Wells in DuPage County that draw from the Midwest Aquigroup range in depth from 1,356 to 1,630 feet and yield 500 to 1,350 gpm (Woller, Sanderson, and Sargent 1986; Zeizel et al. 1962).

The Eau Claire Formation, which underlies the Ironton and Galesville sandstones, acts as a relatively impermeable confining layer that maintains head pressure between the Midwest Aquigroup and the underlying aquifer (Woller, Sanderson, and Sargent 1986; Zeizel et al. 1962).

The deepest aquifer in the region is the Mt. Simon Formation, which constitutes the Basal Bedrock Aquigroup. This aquifer is generally salty and of poor quality. Wells in DuPage County that draw from this aquifer range in depth from 1,793 to 2,062 feet and produce 750 to 1,000 gpm (Woller, Sanderson, and Sargent 1986; Zeizel et al. 1962).

Regional groundwater flow in the shallow bedrock aquifer is toward the Des Plaines River, as determined during the ESI/GPA.

3. PROCEDURES

3.1 INTRODUCTION

On May 24, 1991, FIT began conducting a series of on-site activities that were designed to characterize alleged hazardous wastes, to determine subsurface hydrogeologic conditions, and to determine whether a release of hazardous substances to groundwater had occurred. These activities were conducted in accordance with the U.S. EPA-approved work plan and included surface and subsurface soil sampling, logging and sampling of subsurface borings, installation of monitoring wells, sampling of groundwater in monitoring wells, and analysis of soil and water samples using the U.S. EPA Contract Laboratory Program (CLP). Major site activities were completed on June 29, 1991. Water levels in monitoring wells were measured again on September 19, 1991, to provide additional data. The procedures employed during all of these activities are discussed in the following subsections.

3.2 SURFACE AND SUBSURFACE SOIL SAMPLING

As part of the ESI/GPA of the HM site, FIT collected four subsurface and two surface soil samples (see Figure 3-1 for soil sampling locations). The purpose of this sampling was to identify hazardous substances and estimate their areal extent at the site. Portions of all samples were offered to site representatives but were declined.

Subsurface soil samples S1 through S4 were collected during the boring of monitoring wells MW1D, MW1S, MW2S, and MW3S. The samples were obtained from the boreholes by driving a 2 1/2-inch inside diameter split spoon sampler into the soil ahead of the lead auger or drill bit

FIGURE 3-1

as the hole was advanced. American Society for Testing and Materials guidelines were followed throughout the use of this technique. Split spoon samples were also used to document the stratigraphy of the boreholes and were stored in glass jars by FIT for future reference.

Subsurface sample S1 was collected at a depth of 1 to 2.5 feet during the boring of monitoring well MW1D on May 27, 1991. Subsurface soil sample S2 was collected at a depth of 8 to 9.5 feet during the boring of monitoring well MW1S on May 31, 1991. The soil at this location was coated with a black, oily substance. Monitoring wells MW1S and MW1D are located at the eastern edge of the site, near the area of the former wastewater lagoons. Subsurface soil samples S1 and S2 were collected to determine whether hazardous substances were present in soils near the surface and/or the screened interval of monitoring well MW1S in order to establish the approximate depth of contamination.

Subsurface sample S3 was collected at a depth of approximately 14.5 feet during the boring of monitoring well MW2S on May 31, 1991. The location of monitoring wells MW2S and MW2D is an open area approximately 300 feet south of the area of the former lagoons. Since FIT believed groundwater flow to be north toward the Des Plaines River, monitoring wells MW2S and MW2D were considered to be upgradient of the former lagoons. Sample S3 was collected from the screened interval of upgradient well MW2S and may therefore be considered to represent natural chemical constituents of the soils within the shallow water table aquifer.

Subsurface sample S4 was collected at a depth of approximately 5 to 9 feet during the boring of monitoring well MW3S on June 12, 1991. The location of monitoring wells MW3S and MW3D is at the western edge of the site, near the center of a triangular area of contamination delineated during the SSI of the HM site. The vertices of this triangular area are marked by two shallow groundwater sampling sumps and an on-site well. Each well was found to contain TCL compounds during the SSI (see Figure 2-5 for location of this area). Sample S4 was collected from the screened interval of well MW3S to determine the vertical extent of hazardous substances identified during the SSI.

Surface soil samples S5 and S6 were collected at depths of 0 to 6 inches at the locations of monitoring well nests MW2 and MW3, respectively. Sample S5 was collected approximately 10 feet southwest of MW2S on June 12, 1991. Nest MW2 is considered to be upgradient and sample S5 was collected to determine the natural chemical constituents of surface soils in this area. Sample S6 was collected approximately 6 feet west of well MW3S. Sample S6 was collected to determine whether TCL compounds or Target Analyte List (TAL) analytes were present at the surface of the triangular area identified during the SSI. Descriptions of surface and subsurface soil samples are provided in Appendix B.

Surface soil samples S5 and S6 were collected using a hand trowel and stainless steel bowl. All sampling equipment was decontaminated between uses by scrubbing with a solution of distilled water and detergent (Alconox), followed by a triple-rinse of distilled water. Sample portions collected for volatile organic analysis were transferred directly to sample bottles. The remaining sample portions were placed into a stainless steel bowl, mixed, and then transferred to the appropriate sample bottles, using a stainless steel spoon or a hand trowel (E & E 1987).

As directed by U.S. EPA, all soil samples were analyzed using the U.S. EPA CLP.

3.3 MONITORING WELL BORING

From May 23 to June 29, 1991, six monitoring wells were installed at the HM site. Boring, construction, and development of these wells were performed by Patrick Drilling Company, Inc., of Glen Ellyn, Illinois. Three nests of two wells, one shallow and one deep, were installed. These tasks were directly supervised by E & E FIT Region V personnel.

The six borings were drilled using truck-mounted or all terrain vehicle (ATV)-mounted Central Mine Equipment 75 (CME 75) drill rigs. Boring locations were chosen by FIT and U.S. EPA based on background information gathered earlier in the SSI. The locations were selected to intersect concentrations of hazardous substances, to determine background conditions, and to provide local hydrogeologic information (see Figure 3-2 for monitoring well locations).

A combination of hollow stem augering and rotary wash drilling methods were used. All equipment was decontaminated by steam cleaning prior to drilling, between borings, and upon completion of the project. Potable water was used as a drilling fluid.

In each of the borings, a 4 1/4- or 6 1/4-inch hollow stem auger (HSA) was used to initiate the boring and penetrate the unconsolidated glacial deposits. In each of the three deeper wells, the 6 1/4-inch HSA was used to auger to bedrock and then seated to provide temporary casing. Once the auger was seated, an NX-size core barrel fitted with a 3 7/8-inch diamond bit was used to obtain representative samples of the bedrock to completion depth. The bore hole was then reamed to total depth and washed with potable water.

During drilling of all borings, split spoon samples were collected at 2 1/2-foot intervals from the surface to completion depth or to bedrock. These samples were collected in order to log the stratigraphy of the unconsolidated material, which ranges in thickness from 19 to 25 feet at the site. Samples were obtained by driving a 2 1/2-inch split spoon sampler into the soil ahead of the drill auger as the hole was advanced. FIT well boring logs are provided in Appendix C.

Drilling began on May 23, 1991, using the CME 75 ATV. The only complication of the drilling occurred when a boulder field was encountered during the drilling of well MW1D on May 31, 1991, and MW3D on June 12, 1991. Initial attempts at advancing the auger at both locations were impeded because of large boulders encountered above the bedrock surface. Two borings were abandoned at nest MW1 and one boring was abandoned at nest MW3. Once the bedrock was encountered at these locations, the auger was removed and a 6-inch, nongalvanized, low-carbon temporary steel casing was advanced to the bedrock surface to control blow-in in the borehole for wells MW1D and MW3D. The abandoned holes were grouted to the level of the surface.

3.4 MONITORING WELL CONSTRUCTION AND INSTALLATION

Monitoring wells were installed in all six completed borings at the HM site (see Figure 3-2 for monitoring well locations). Each FIT-installed well was constructed of type 304 stainless steel well pipe, with schedule 5 flush joints, and a continuously wound stainless steel

FIGURE 3-2

well screen with a slot size of 0.0010 inches. Well screens 10 feet in length were installed in monitoring wells MW1S, MW1D, MW2D, and MW3D. Well screens 5 feet in length were installed in monitoring wells MW2S and MW3S. The nominal inside diameter of the pipe and well screen was 2 inches, and all the joints were flush threaded. A stainless steel cap was placed at the bottom of each well screen to prevent the intrusion of the filter pack material. Well screens, riser pipes, and caps were removed from sealed plastic prior to installation into the well. The annulus between the screen and the borehole was packed with silica filter sand to approximately 3 feet above the screen/riser connection. A bentonite clay seal was added to the top of the sand pack to seal the well as needed. Each well was grouted with high clay-solids grout to the ground surface. The tops of the riser pipes, each of which extended to approximately 2 feet above the ground surface, were then surrounded by a 5-foot length of 4-inch by 4-inch galvanized steel protective casing with a hinged, locking cap. Each protective casing was surrounded by a concrete pad of approximately 28 inches by 28 inches by 24 inches. The surface of each concrete pad was constructed to slope away from the well to provide drainage. A hole was placed in each protective casing near the surface at the concrete pad to allow for drainage of any water that could potentially accumulate in the casing. At all monitoring well locations, 4-inch diameter steel bumper guards 8 feet in length were installed to protect the wells from collision damage. Each bumper post was placed in a boring approximately 3 to 4 feet deep, and each post was then filled with concrete (see Figure 3-3 for typical monitoring well construction and Appendix C for as-built diagrams of each monitoring well).

Monitoring well nests were designated MW1 through MW3, with the suffixes D and S identifying the deep and shallow wells at each nest.

After installation, each well was developed using a Brainard-Kilman pump until measurements of turbidity, temperature, pH, and conductivity stabilized, indicating that representative groundwater was being drawn from the well. A minimum of 10 volumes of water were removed from each well (see Appendix C for development logs for FIT-installed monitoring wells). Between the development of each well, the

FIGURE 3-3

Brainard-Kilman pump and tubing were washed with an Alconox and distilled water solution, then triple-rinsed with distilled water. All monitoring well water was placed in 55 gallon drums for off-site disposal (see Table 3-1 for monitoring well data).

3.5 WATER LEVEL MEASUREMENTS

Static water level measurements were taken in all monitoring wells on June 28 and September 19, 1991. Water levels were determined using a chalked stainless steel tape. Before each use, the tape was washed in a solution of Alconox and distilled water, then triple-rinsed with distilled water. Water levels were measured to help develop piezometric surface and to calculate horizontal and vertical hydraulic gradients. Results of these measurements are discussed in Section 4.

3.6 GROUNDWATER SAMPLING

Groundwater samples were collected for chemical analysis from six on-site monitoring wells installed by FIT on June 27, 1991.

Prior to sampling each well, FIT measured water levels and calculated the static water volume. A minimum of three volumes of water was purged from each well, or the well was purged dry, before each sample was collected. Wells were purged with stainless steel bailers or a Brainard-Kilman pump. Stainless steel bailers were used to collect the samples. Sample portions were shared with Versar, Inc., an environmental consulting firm representing Hannah Marine Corporation. All equipment was decontaminated between the sampling of each well with an Alconox and distilled water solution and then triple-rinsed with distilled water.

All monitoring well samples were packaged and shipped to CLP laboratories or Central Regional Laboratory (CRL) laboratories to be analyzed for TCL compounds and TAL analytes. The TCL and TAL are included with corresponding quantitation/detection limits in Appendix D. All purge water was drummed and stored on-site for later removal.

Table 3-1

MONITORING WELL DATA

Well Number	Total Depth (feet below ground surface)	Screened Interval	Top of Inside Casing* (feet above MSL)
MW1S	18.5	581.91-571.91	592.41
MW1D	78.5	529.36-524.36	593.06
MW2S	15.5	590.65-585.65	604.33
MW2D	cored to 81.0; reamed to 69.5	540.73-530.73	603.53
MW3S	11.0	585.11-575.11	593.21
MW3D	80.0	531.26-521.26	595.36

* Surveyed into USGS benchmark at 626 feet above MSL.

FIT-collected groundwater samples from on-site monitoring wells were designated as follows.

Sample	Well
MW1	MW1S
MW2	MW1D
MW3	MW2S
MW4	MW2D
MW5	MW3S
MW6	MW3D

3.7 DISPOSAL OF INVESTIGATION-DERIVED WASTE

Following standard U.S. EPA policy for ESI/GPA sites, FIT will ensure that all potentially hazardous investigation-derived materials are appropriately containerized for removal. Such wastes include all drilling spoils (cuttings), drilling fluids, purge water, decontamination fluids, and disposable personal protective equipment used on-site. The FIT drilling subcontractor performed the actual containerization each day using sealable 55-gallon Department of Transportation (DOT)-approved drums. Investigation-derived waste materials, including drilling fluids, soil cuttings, well development and purge water, and disposable protective clothing from the field investigation were placed in 55-gallon drums and will be removed from the site under FIT supervision and transported to a licensed disposal facility off-site.

4. RESULTS AND DISCUSSION

4.1 INTRODUCTION

This section presents results of ESI/GPA field work at the HM site during May and June 1991. Results include chemical analysis of FIT-collected soil and monitoring well samples, site specific geology and stratigraphy, and groundwater hydrology.

4.2 CHEMICAL ANALYSIS OF FIT-COLLECTED SAMPLES

Analytical results of FIT-collected soil and groundwater samples are provided in Appendix E. Results of soil sampling analysis are presented in Table 4-1. Results of monitoring well sampling analysis are presented in Table 4-2. All samples were analyzed for volatile organics, semivolatile organics, pesticides/polychlorinated biphenyls (PCBs), metals, and cyanide.

Quantitation/detection limits used in the analysis of FIT-collected samples are provided in Appendix D.

The analytical data for the chemical analysis of soil and monitoring well samples collected for this ESI/GPA have been reviewed by U.S. EPA for compliance with the terms of CLP, and the review has been approved by U.S. EPA. The analytical data have also been reviewed by FIT for validity and usability. Any additions, deletions, or changes to the data have been incorporated in Tables 4-1 and 4-2.

Soil Sampling Analysis. Surface and subsurface soil samples were collected from six locations (see Figure 3-1 for soil sampling locations). In CLP-analyzed soil samples from the HM site, elevated concentrations of a halogenated hydrocarbon, a ketone, and an aromatic

Table 4-1
RESULTS OF CHEMICAL ANALYSIS OF
FIT-COLLECTED SOIL SAMPLES

Sample Collection Information and Parameters	Sample Number S1	S2	S3	S4	S5	S6
Date	5/23/91	5/31/91	5/31/91	6/12/91	6/12/91	6/12/91
Time	1245	0842	1450	1240	1530	1555
CLP Organic Traffic Report Number	ENJ20	ENJ21	ENJ22	ENJ23	ENJ24	ENJ25
CLP Inorganic Traffic Report Number	MEGY20	MEGY21	MEGY22	MEGY23	MEGY24	MEGY25
Compound Detected (values in µg/kg)						
Volatile Organics						
methylene chloride	63	240BD	--	--	--	--
acetone	--	340BD	--	--	--	--
carbon disulfide	--	--	--	1J	0.8J	0.9J
chloroform	3J	--	--	--	--	--
1,1,1-trichloroethane	21	--	--	--	--	--
benzene	--	1,200ED	--	--	--	--
tetrachloroethene	20	--	--	--	--	--
toluene	--	17JD	--	11	--	24
Semivolatile Organics						
phenanthrene	--	--	--	NR	130J	--
fluoranthene	--	--	--	NR	220J	110J
pyrene	--	--	--	NR	270J	110J
benzo[a]anthracene	--	--	--	NR	130J	--
chrysene	--	--	--	NR	150J	96J
benzo[b]fluoranthene	--	--	--	NR	120J	--
benzo[k]fluoranthene	--	--	--	NR	150J	--
benzo[a]pyrene	--	--	--	NR	110J	--

Table 4-1 (Cont.)

Sample Collection Information and Parameters	Sample Number S1	S2	S3	S4	S5	S6
Analyte Detected† (values in mg/kg)						
aluminum	1,700*EJ	2,070	2,170	NR	17,500	13,600
antimony	--	--	--	NR	R	R
arsenic	6.90NJ	R	R	NR	6.0*	2.6*
barium	8.60B	6.5B	7.3B	NR	64.9	103
beryllium	--	--	--	NR	1.0B	0.83B
cadmium	--	2.3	3.4	NR	7.2	6.1
calcium	164,000	156,000	147,000	NR	25,100*J	38,400*J
chromium	5.70*J	5.3	3.9	NR	21.0	20.3
cobalt	3.10B	3.6B	2.5B	NR	14.1	9.7B
copper	7.90	10	21	NR	39.3NJ	33.7NJ
iron	11,000*EJ	8,600EJ	13,100EJ	NR	25,500E*J	24,700E*J
lead	7.00N*J	--	12.55N*J	NR	19.4	37.6
magnesium	85,100EJ	85,300EJ	82,100EJ	NR	17,400*	22,500*
manganese	319N*EJ	377ENJ	621ENJ	NR	297N*J	321N*J
mercury	--	--	--	NR	--	0.12
nickel	6.20B	7.7	8.7	NR	35.4	31.7
potassium	549B	634B	839B	NR	2,200	2,690
sodium	R	R	R	NR	--	--
thallium	953BEJ	237B	306B	NR	768BEJ	361BEJ
vanadium	8.40B	--	1.3B	NR	28.6*	23.7*
zinc	25	30.1EJ	40.3EJ	NR	70.5EJ	215EJ

-- Not detected.

† Laboratory reported no results (NR) for the semivolatile organics, pesticides/PCBs, and analytes portions of sample S4.

Table 4-1 (Cont.)

COMPOUND QUALIFIERS	DEFINITION	INTERPRETATION
J	Indicates an estimated value.	Compound value may be semiquantitative.
B	This flag is used when the compound is found in the associated blank as well as in the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.	Compound value may be semiquantitative if it is <5x the blank concentration (<10x the blank concentrations for common laboratory artifacts: phthalates, methylene chloride, acetone, toluene, 2-butanone).
E	This flag identifies compounds whose concentrations exceed the calibration range of the GC/MS instrument for that specific analysis. This flag will not apply to pesticides/PCBs analyzed by GC/EC methods.	Compound value may be semiquantitative. There should be another analysis with a D qualifier, which is to be used.
D	This flag identifies all compounds identified in an analysis at a secondary dilution factor.	Alerts data user to a possible change in the CRQL. Data is quantitative.

ANALYTE QUALIFIERS	DEFINITION	INTERPRETATION
E	Estimated or not reported due to interference. See laboratory narrative.	Analyte or element was not detected, or value may be semiquantitative.
N	Spike recoveries outside QC protocols, which indicates a possible matrix problem. Data may be biased high or low. See spike results and laboratory narrative.	Value may be quantitative or semiquantitative.
*	Duplicate value outside QC protocols which indicates a possible matrix problem.	Value may be quantitative or semiquantitative.
B	Value is real, but is above instrument DL and below CRDL.	Value may be quantitative or semiquantitative.
J	Value is above CRDL and is an estimated value because of a QC protocol.	Value may be semiquantitative.

Table 4-1 (Cont.)

ANALYTE QUALIFIERS	DEFINITION	INTERPRETATION
W	Post-digestion spike for furnace AA analysis is out of control limits (35-115%), while sample absorbance is <50% of spike absorbance.	Value may be semiquantitative.
R	Results are unusable due to a major violation of QC protocols.	Analyte value is not usable.

Table 4-2
RESULTS OF CHEMICAL ANALYSIS OF
FIT-COLLECTED MONITORING WELL SAMPLES

Sample Collection Information and Parameters	Sample Number MW1	Duplicate	MW2	MW3	MW4	MW5	MW6	Blank	INTERPRETATION
Date	6/26/91	6/26/91	6/26/91	6/27/91	6/27/91	6/27/91	6/27/91	6/26/91	
Time	1505	1505	1605	1115	1045	1410	1515	1815	
CLP Organic Traffic Report Number	ENN81	ENN87	ENN82	ENN83	ENN84	ENN85	ENN86	ENN88	
CLP Inorganic Traffic Report Number	MEGY81	MEGY87	MEGY82	MEGY83	MEGY84	MEGY85	MEGY86	MEGY88	
Temperature (°C)	-	-	-	-	-	-	-	-	
Specific Conductivity (µmhos/cm)	-	-	-	-	-	-	-	-	
pH	-	-	-	-	-	-	-	-	
Compound Detected (values in µg/L)									
Volatile Organics									
1,1-dichloroethene (total)	--	--	--	--	--	--	2J	--	Compound value may be semiquantitative.
benzene	11,000ED	9,600D	5J	--	--	--	--	--	Compound value may be semiquantitative. There should be another analysis with a D qualifier, which is to to be used.
4-methyl-2-pentanone	--	--	--	--	--	--	--	3J	
2-hexanone	--	--	--	--	--	--	--	4J	Alerts data user to a possible change in the CRQL. Data is quantitative.
ethylbenzene	5JD	--	--	--	--	--	--	--	
xylenes (total)	--	--	--	--	3J	--	--	--	
Semivolatile Organics									INTERPRETATION
Phenol	--	95	--	--	--	--	--	--	Value is quantitative.
Analyte Detected (values in µg/L)									
aluminum	--	--	1,480	--	--	--	--	--	Value may be quantitative or semiquantitative.
antimony	--	27.2B	--	--	--	--	--	--	
arsenic	2.2B	--	--	1.3B	--	--	1.4B	--	Value may be quantitative or semiquantitative.
barium	55.3B	--	43.0B	11.3B	21.9B	10.9B	54.6B	--	
calcium	286,000	93.2B	201,000	312,000	26,3000	172,000	288,000	--	
chromium	--	--	202	--	--	--	--	--	Value may be quantitative or semiquantitative.
cobalt	--	6.3B	6.3BJ	6.7BJ	7.9BJ	--	--	--	
copper	--	--	8.0BJ	--	5.0BJ	5.0JB	--	--	Value may be semiquantitative.
iron	242	25.4JB	4,060	2,490	--	42.0JB	220	--	
lead	--	1.7JBN	11.9JsN	--	--	--	--	--	
magnesium	98,300	39.5B	97,700	142,000	65,700	83,800	97,200	--	
manganese	82.0	--	119	106	75.1	29.5	86.1	--	
mercury	0.2	--	--	--	--	--	--	--	
nickel	--	--	102	7.5B	15.1	9.6B	--	--	
potassium	13,700	--	6,100	4,520B	6,560	8,440	13,200	--	
sodium	161,000	314B	68,500	33,700	80,500	120,000	156,000	--	
zinc	--	--	30.9	--	--	--	--	--	
cyanide	--	--	--	9.7Jx	--	--	--	--	

- Data is not available.
-- Not detected.
† Laboratory reported no results (NR) for the semivolatile organics and pesticides/PCBs portions of sample MW3.

Table 4-2 (Cont.)

COMPOUND QUALIFIERS	DEFINITION
J	Indicates an estimated value.
E	This flag identifies compounds whose concentrations exceed the calibration range of the GC/MS instrument for that specific analysis. This flag will not apply to pesticides/PCBs analyzed by GC/EC methods.
D	This flag identifies all compounds identified in an analysis at a secondary dilution factor.

ANALYTE QUALIFIERS	DEFINITION
S	Analysis by Method of Standard Additions.
N	Spike recoveries outside QC protocols, which indicates a possible matrix problem. Data may be biased high or low. See spike results and laboratory narrative.
*	Duplicate value outside QC protocols which indicates a possible matrix problem.
B	Value is real, but is above instrument DL and below CRDL.
J	Value is above CRDL and is an estimated value because of a QC protocol.

hydrocarbon were detected. Methylene chloride (240BD µg/kg) and acetone (340BD µg/kg) were detected in subsurface sample S2 (see Table 4-1 for definitions and interpretations of qualifiers). These compounds were not detected in surface sample S6, which is considered to be the background sample, and may be attributable to the site. Benzene (1,200ED µg/kg) was also detected above the background level in sample S2 and is probably attributable to the site.

TAL analytes were detected at low levels in surface and subsurface soil samples.

Monitoring Well Sampling Analysis. Water samples were collected from each of six FIT-installed monitoring wells as part of the ESI/GPA for the HM site. Benzene was detected in sample MW1 (collected from well MW1S) at a concentration of 11,000ED µg/L (see Table 4-2 for definitions and interpretations of qualifiers). Benzene was not detected in the upgradient monitoring wells (MW2S and MW2D) and is attributable to the site.

The TAL analyte chromium was detected in sample MW2 (collected from well MW1D) at a concentration of 202 µg/L. Chromium was not detected in the upgradient monitoring wells (MW2S and MW2D) and is potentially attributable to operations at the site.

Discussion of Sampling Results. The analysis of soil samples from the HM site confirms that a zone of contamination exists in the on-site soil. This zone contains TCL compounds that FIT believes were leaked or dumped as a result of the chemical barge cleaning operations at the site. This zone of contamination is found in the borehole of well MW2 at a depth of 8 to 9 1/2 feet beneath the surface, but likely extends both above and below this level.

The presence of the TCL compound benzene in FIT-collected groundwater sample MW1 (collected from monitoring well MW1S) indicates that compounds from the zone of contaminated soil have migrated to groundwater. The concentration of benzene in sample MW1 (11,000ED µg/L) is sufficiently high to constitute an observed release.

The presence of the TAL analyte chromium in FIT-collected groundwater sample MW2 (collected from well MW1D) suggests that a deeper level of contamination may exist. FIT believes that this deeper level represents a stratification of various hazardous substances that has

developed as a result of differences in the solubility, persistence, molecular weight, and time of dumping of these hazardous substances.

TCL compounds and TAL analytes detected above background levels in FIT-collected soil and groundwater samples are believed by FIT to be attributable to the site because an unknown quantity of unidentified wastewater and waste chemicals were dumped into two unlined lagoons near the center of the site from 1958 to 1978. FIT believes that hazardous substances have infiltrated the substrate through the unlined walls and floors of these lagoons.

4.3 SITE-SPECIFIC GEOLOGY AND STRATIGRAPHY

The geology of the HM site was characterized by analyzing soil samples and soil/rock borings collected during the hydrogeologic investigation and reviewing the background data, maps, and literature. Characterization of the site geology was in part based on visual inspection of soil/rock samples collected during the drilling of monitoring wells. Descriptions of the soil samples are included in the logs of FIT-collected soil/rock borings. A fence diagram has also been prepared to illustrate the stratigraphy of the site area (see Figure 4-1 for a geologic fence diagram of the site and Appendix F for well logs of the area of the site).

Fill material ranging in thickness from 0 to approximately 7 feet rests atop the thin blanket of glacially derived unconsolidated deposits at monitoring well nests MW2 and MW3. The fill material is composed of a mixture of clay, sand, and gravel. The unconsolidated Quaternary glacial deposits range in thickness from approximately 21 1/2 to 27 feet in thickness at the site, and consist of a dense-to-very-dense dark gray and medium-brown clay with trace sand and small amounts of coarse-to-fine gravel. These materials are presumed to have been deposited as till and ground moraine deposits.

Beneath the unconsolidated deposits is a glacially eroded surface that consists of a severely eroded bedrock surface overlain by glacially derived boulders. During the drilling of well MW1D, the drill rig encountered a boulder of granite.

FIGURE 4-1

The bedrock beneath this boulder field is the Silurian Joliet Dolomite. The light gray, slightly vuggy dolomite had little chert throughout the formation, was fractured, and contained abundant dark brown staining. Veins of pyrite were also present, and pyrite was observed in the fractured zones. Green staining and veins were also present throughout the entire specimen. A few fossils were present, including a cephalopod and some corals. The horizontal breaks were slightly argillaceous. Fractures in the bedrock were both vertical and horizontal. The horizontal fractures were most likely caused by mechanical breaks, and the vertical fractures were oriented from approximately 45 to 180 degrees from the horizontal plane of the core samples. Regional dip of the bedrock is less than 1 degree to the southeast (Zeizel et al. 1962).

4.4 GROUNDWATER HYDROLOGY

Groundwater levels were measured in all of the FIT-installed monitoring wells on June 29 and September 19, 1991 (see Table 4-3 for monitoring well water level measurements).

Figure 4-2 is a map of the water surface in the shallow unconsolidated aquifer beneath the HM site. This map was constructed by plotting water levels from the June 1991 measurements and interpolating contours of equal water surface elevations. These water levels indicate that the hydrostatic head, or water level, in the southeastern portion of the site is approximately 3 feet greater than in the northwestern portion of the site. The contours indicate that local groundwater flow generally follows the site topography, with the horizontal gradient becoming steeper along the SSC. Movement of groundwater is generally perpendicular to the contours and is therefore considered to be from the southeast to the northwest, toward the SSC and the Des Plaines River.

Figure 4-3 is a map of the piezometric surface of the deeper bedrock aquifer at the HM site. The difference in the hydrostatic head at the southeastern portion of the site is approximately 8 feet greater than in the northwestern portion of the site. Groundwater flow is considered to be from the southeast to the northwest, also toward the Des Plaines River.

Groundwater Gradients. Horizontal water level gradients between monitoring well nests MW1 and MW2 are presented in Table 4-4. These

Table 4-3

MONITORING WELL WATER LEVEL MEASUREMENTS
(feet above MSL)

Well	June 28, 1991	September 19, 1991
MW1S	583.01	582.23
MW1D	582.56	581.95
MW2S	587.53	Dry
MW2D	591.03	584.23
MW3S	585.81	581.61
MW3D	585.46	584.26

FIGURE 4-2

FIGURE 4-3

Table 4-4

HORIZONTAL HYDRAULIC GRADIENTS IN MONITORING WELLS*

Transect	Gradient (feet/feet)
MW1S to MW2S	0.006
MW1D to MW2D	0.012

* Based on data of June 28, 1991.

gradients were calculated as the difference between the hydrostatic head between wells (in feet) divided by the approximate horizontal distance between the wells (in feet). The gradient transect between nests MW1 and MW2 was chosen because it most closely parallels the inferred direction of groundwater flow.

Vertical hydraulic gradients at the three monitoring well nests were calculated using the following formula.

> Vertical gradient = dh/dl,
> where dh = (head of shallow well) - (head of deep well)
> and dl = vertical distance in feet between the midpoints of shallow and deep screens.

The calculated vertical gradients are shown in Table 4-5. This formula yields positive numbers where the head in the shallow well is higher than the head in the deeper well, and negative numbers where the levels are reversed. The consistent positive values for nest MW1 indicate that there is downward flow, or at least a tendency toward downward flow, of groundwater in the area of the site. This is near the area of the former unlined lagoons, and monitoring wells MW1S and MW1D were found to contain high levels of TCL compounds and TAL analytes.

4.5 GROUNDWATER TARGETS

The principal aquifer in the site area and the aquifer of concern (AOC) is the shallow Upper Bedrock Aquigroup (Woller, Sanderson, and Sargent 1986) (see Appendix F for well logs of the area of the site). The cities of Darien, Rosewood, Lake of the Woods, and Lemont operate municipal wells within a 4-mile radius of the site that draw from this aquifer. The populations served by these municipal water systems are: Darien, 4,500; Rosewood, 5,066; Lake of the Woods, 2,952; and Lemont, 6,858 (Lemont Water Department 1991; Darien Department of Public Works 1991; DuPage County Department of Public Works 1991). Argonne National Laboratory operates three wells within a 4-mile radius of the site, which serve 4,000 employees (Locker 1991). The Tri-State water system is an independently owned water supplier that serves 700 persons within a 4-mile radius of the site.

Table 4-5

VERTICAL HYDRAULIC GRADIENTS IN NESTED WELLS

Well Nest	Gradient Measured June 28, 1991 (feet/feet)	Gradient Measured September 19, 1991 (feet/feet)
MW1	+ 0.008	+ 0.005
MW2	- 0.067	N/A
MW3	+ 0.009	- 0.066

Persons not served by these distribution systems rely on private wells for their drinking water. The number of persons using private wells within a 4-mile radius of the site is 2,670. This number was obtained by counting houses on USGS topographic maps and multiplying by the number of persons per household in Cook, DuPage, and Will counties (USGS 1962, 1963, 1963a; U.S. Bureau of the Census 1980).

The total groundwater target population within a 4-mile radius of the HM site is 26,746 persons. The private well nearest to the site is located approximately 1/4 mile northwest of the site.

Based on FIT determinations of groundwater flow, all of these wells are upgradient of the HM site. No private wells are located between the site and the Des Plaines River.

5. SUMMARY

The following conclusions can be drawn from the results of the ESI/GPA for the HM site.

- There are two main aquifers in the subsurface at the HM site. Drilling logs show that the upper aquifer is found in unconsolidated sand and gravel glaciogenic deposits, and the lower aquifer is found in the fractured and eroded underlying dolomite. There is no continuous confining layer between the two aquifers and they are considered to be hydraulically connected. In the northeastern portion of the site there is a consistent downward vertical hydraulic gradient toward the lower aquifer. Therefore, the upper and lower aquifers together constitute the AOC.

- Groundwater flow in both aquifers is to the northwest, toward the Des Plaines River.

- TCL compounds and TAL analytes are present above background and upgradient levels in the subsurface soil and groundwater at the HM site.

- Only a few TCL compounds were detected in groundwater in the subsurface of the HM site. An observed release of benzene (11,000ED µg/L) has been documented in well MW1S, through FIT-conducted groundwater sampling.

- The downward vertical gradient of groundwater flow at well MW1D indicates that TCL compounds and TAL analytes may infiltrate the Silurian dolomite aquifer. This bedrock is part of the shallow Upper Bedrock Aquigroup, which serves as a drinking water source for area residents upgradient of the HM site.

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7480:3

APPENDIX A

FIT SITE PHOTOGRAPHS

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: > HANNAH MARINE CORP. PAGE > 1 OF > 7

U.S. EPA ID: > ILD069496248 TDD: > F-05-8810-002 PAN: > FILO277XBR

DATE: >

TIME: >

DIRECTION OF PHOTOGRAPH:
> NE

WEATHER CONDITIONS:
> CLOUDY

>

PHOTOGRAPHED BY:
>

SAMPLE ID (if applicable):
> S1, S2, MW1, MW2

FIT PHOTOS
DID NOT COME OUT

DESCRIPTION: > WELL NEST MW1, CLOSE-UP, MW15 ON RIGHT, MW10 ON LEFT, SAMPLE S1 TAKEN
> FROM MW10, SAMPLE S2 TAKEN FROM MW15; GROUNDWATER SAMPLE MW1 TAKEN FROM MW15, SAMPLE MW2 TAKEN FROM MW10

DATE: >

TIME: >

DIRECTION OF PHOTOGRAPH:
>

WEATHER CONDITIONS:
>

>

PHOTOGRAPHED BY:
>

SAMPLE ID (if applicable):
>

FIT PHOTOS
DID NOT COME OUT

DESCRIPTION: > WELL NEST MW1, PERSPECTIVE,

>

SI008(2/25/89)

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: > HANNAH MARINE PAGE >2 OF > 7

U.S. EPA ID: >ILD064496248 TDD: > F05-8810-002 PAN: > FIL0277XBR

DATE: >

TIME: >

DIRECTION OF PHOTOGRAPH:
>

WEATHER CONDITIONS:
>

>

PHOTOGRAPHED BY:
>

SAMPLE ID (if applicable):
> S3, S5, MW3, MW4

FIT PHOTOS DID NOT COME OUT

DESCRIPTION: > WELL NEST MW2, CLOSE-UP, MW2S ON LEFT, MW2D ON RIGHT, SAMPLE S3 > TAKEN FROM MW2S, SAMPLE S5 TAKEN FROM SURFACE IN FOREGROUND, SAMPLE MW3 TAKEN FROM MW2S, MW4 TAKEN FROM WELL MW1D

DATE: >6/28/91

TIME: > 0915.

DIRECTION OF PHOTOGRAPH:
> NW

WEATHER CONDITIONS:
> SUNNY

> ~80°

PHOTOGRAPHED BY:
> D. BARRETT

SAMPLE ID (if applicable):
>

DESCRIPTION: > WELL NEST MW2, PERSPECTIVE,

>

SI008(2/25/89)

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: > HANNAH MARINE CORP. PAGE >3 OF > 7

U.S. EPA ID: >ILD069496248 TDD: > F05-8810-002 PAN: > FIL0277XBR

DATE: >

TIME: >

DIRECTION OF PHOTOGRAPH:
>

WEATHER CONDITIONS:
>

>

PHOTOGRAPHED BY:
>

SAMPLE ID (if applicable):
> S4, S6, MW 5, MW6

FIT PHOTOS DID NOT COME OUT

DESCRIPTION: > WELL NEST MW3, CLOSE-UP, MW3S ON RIGHT, MW3D ON LEFT, SAMPLE S4 > TAKEN FROM MW3S, S6 TAKEN FROM SURFACE IN FOREGROUND, GROUNDWATER SAMPLE MW5 TAKEN FROM MW3S, SAMPLE MW6 TAKEN FROM MW3D

DATE: >6/29/91

TIME: > 1011

DIRECTION OF PHOTOGRAPH:
> N

WEATHER CONDITIONS:
> SUNNY

> ~ 85°

PHOTOGRAPHED BY:
> D. BARRETT

SAMPLE ID (if applicable):
>

DESCRIPTION: > WELL NEST MW3, PERSPECTIVE,

>

SI008(2/25/89)

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: > HANNAH MARINE CORP. PAGE >4 OF > 7

U.S. EPA ID: >ILD069496248 TDD: >F-05-8810-002 PAN: > FIL0277XBR

DATE: >6/29/91

TIME: > 1001

DIRECTION OF PHOTOGRAPH:
> W

WEATHER CONDITIONS:
> SUNNY

> ~85°F

PHOTOGRAPHED BY:
> D. BARRETT

SAMPLE ID (if applicable):
>

DESCRIPTION: > PERSPECTIVE, MAIN BUILDING COMPLEX, NOTE AREA OF DRUM STORAGE

> IN MIDGROUND

DATE: > 6/29/91

TIME: > 1010

DIRECTION OF PHOTOGRAPH:
> NE

WEATHER CONDITIONS:
> SUNNY

> ~85° F

PHOTOGRAPHED BY:
> D BARRETT

SAMPLE ID (if applicable):
>

DESCRIPTION: >SITE PERSPECTIVE, CHICAGO SANITARY AND SHIP CANAL ON LEFT,

> MAIN OFFICE BUILDING AT MIDGROUND ON RIGHT, RT. 83 OVERPASS IN BACKGROUND

SI008(2/25/89)

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: > HANNAH MARINE CORP. PAGE > 5 OF > 7

U.S. EPA ID: > ILD069496248 TDD: > F05-8810-002 PAN: > FL0277XBR

DATE: > 6/29/91

TIME: > 1010

DIRECTION OF PHOTOGRAPH: > SW

WEATHER CONDITIONS: > SUNNY

> ~85°F

PHOTOGRAPHED BY: > D. BARRETT

SAMPLE ID (if applicable): >

DESCRIPTION: > VACUUM TANK AND FUEL STORAGE TANK AREA, NOTE CONCRETE WALL

> WHICH SURROUNDS AREA

DATE: > 6/29/91

TIME: > 1000

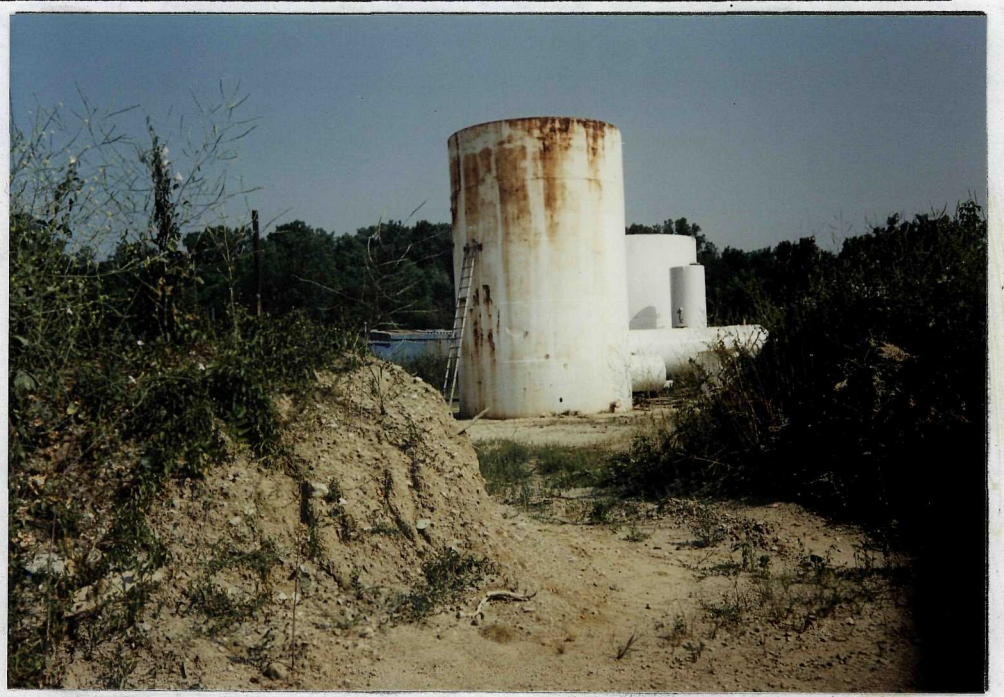
DIRECTION OF PHOTOGRAPH: > NW

WEATHER CONDITIONS: > SUNNY

> ~85°F

PHOTOGRAPHED BY: > D. BARRETT

SAMPLE ID (if applicable): >



DESCRIPTION: > CLOSEUP OF STORAGE TANKS WITHIN EARTHEN-BERMED AREA,

> NOTE RUST ON TANK IN FOREGROUND

SI008(2/25/89)

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: > HANNAH MARINE CORP. PAGE >6 OF > 7

U.S. EPA ID: > ILD069946248 TDD: > F05-8810-002 PAN: > FL0277XBR

DATE: > 6/29/91

TIME: > 0951

DIRECTION OF PHOTOGRAPH: > SSW

WEATHER CONDITIONS: > SUNNY

> ~85°F

PHOTOGRAPHED BY: > D. BARRETT

SAMPLE ID (if applicable): >

DESCRIPTION: > TANK STORAGE AREA, WHITE TANKS ARE WITHIN EARTHEN-BERMED

> AREA, TO THE LEFT TOP OF NEWER TANK IS VISIBLE

DATE: > 6/29/91

TIME: > 0953

DIRECTION OF PHOTOGRAPH: > E

WEATHER CONDITIONS: > SUNNY

> ~85°F

PHOTOGRAPHED BY: > D. BARRETT

SAMPLE ID (if applicable): >

DESCRIPTION: > NEW STORAGE TANK, LOCATED APPROXIMATELY 50 FEET NE OF

> EARTHEN-BERMED AREA

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: HANNAH MARINE CORP. PAGE 7 OF 7

U.S. EPA ID: ILD069496248 TDD: F05-8810-002 PAN: FILO2TTXBR

DATE: > 6/29/91 TIME: > 0951 DIRECTION OF PHOTOGRAPH: > SW-SE PHOTOGRAPHED BY: > D. BARRETT

WEATHER CONDITIONS: > SUNNY N85OF SAMPLE ID (if applicable): >

DESCRIPTION: > EASTERN PORTION OF SITE, BELIEVED TO BE FORMER LAGOON AREAS, STORAGE TANK AREA IN MIDGROUND AT RIGHT. ROUTE 83 OVERPASS IS REFLECTED IN MIRROR.

APPENDIX B

SURFACE AND SUBSURFACE SOIL SAMPLE DESCRIPTIONS

SURFACE AND SUBSURFACE SOIL SAMPLE DESCRIPTIONS

Sample	Location	Depth (feet)	Description
S1	MW1S	1 - 2.5	Light brown fine coarse gravel, with some fine to coarse sand
S2	MW1D	8 - 9.5	Coarse sand and gravel coated with a black, odiferous organic residue
S3	MW2S	14.5	Brown sand and gravel with minor clay, saturated
S4	MW3S	5.0 - 9.0	Fill material, silty, clayey sand, some coarse to fine gravel, some limestone rock chips, and dark gray quartz sand
S5	Near MW2S	Surface	Fill material, same as above
S6	Near MW3S	Surface	Fill material, same as above

APPENDIX C

FIT WELL BORING LOGS, AS-BUILT DIAGRAMS, AND DEVELOPMENT LOGS

Hole No. MW1D

DRILLING LOG | DIVISION | INSTALLATION | SHEET 1 OF 4 SHEETS

1. PROJECT: HANNAH MARINE, LEMONT, IL
2. LOCATION (Coordinates or Station): NE CORNER, ~5-20' WEST OF 83 OVERPASS
3. DRILLING AGENCY: PATRICK DRILLING
4. HOLE NO. (As shown on drawing title and file number): MW1D
5. NAME OF DRILLER: TED ZWOLINSKI
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 16.5'
8. DEPTH DRILLED INTO ROCK: 4.5'
9. TOTAL DEPTH OF HOLE: 21'
10. SIZE AND TYPE OF BIT:
11. DATUM FOR ELEVATION SHOWN (MSL or ASL):
12. MANUFACTURER'S DESIGNATION OF DRILL: CME 75
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 8; UNDISTURBED -
14. TOTAL NUMBER CORE BOXES: 1
15. ELEVATION GROUND WATER: 8.0
16. DATE HOLE: STARTED 5/23/91; COMPLETED 5/24/91
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 4.0'
19. SIGNATURE OF INSPECTOR: PAT VOJACK

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	REC./RUN (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
			Brownish black organic topsoil			
			LIGHT BROWN FINE-COARSE GRAVEL, SOME FINE-COARSE SAND, MOTTLED, MED DENSE, DRY SP	10"/18"	SS1 1.0'-2.5'	6/19/15 ENVIRONMENTAL CLIP SAMPLE (S1)
			DARK BROWN SILTY CLAY, LITTLE FINE SAND, STIFF, DRY ML-CL			
	5		YELLOWISH-BROWN FINE COARSE SAND & GRAVEL, MED DENSE DRY SP	10"/18"	SS2 3.5'-5.0'	5/19/16 LARGE LIGHT GRAY COBBLES (DOLOMITE/LIMESTONE)
			1" PIECE OF BROWN SAND, SILT LITTLE SAND, LITTLE GRAVEL, SLIGHTLY MOIST, ML	1"/18"	SS3 6.0'-7.5'	LARGE PIECE OF GRAVEL WEDGED IN TOE OF SPOON
						DRILLER ENCOUNTERS WATER AT 8 FEET
	10		BLACK-COATED FINE COARSE SAND AND GRAVEL, SLIGHT ODOR, DENSE, SATURATED SP	12"/18"	SS4 8.5'-10.0'	4/10/31 0.2 PPM ON OVA
						2½-3' of BLOW-IN
			BLACK-COATED FINE-COARSE SAND & GRAVEL, MED DENSE, SATURATED SP	10"/18"	SS5 11.5'-13.0'	6/6
6/17/91 WATER AT 13.2'			LIGHT GRAY SANDY SILT, LITTLE GRAVEL, TRACE CLAY, STIFF, MOIST ML			0.7 PPM ON OVA FROM BOREHOLE - ALLOW HOLE TO VENT
	15	MAY BE BLOW-IN	YELLOWISH BROWN FINE-COARSE SAND AND GRAVEL, DENSE SATURATED SP	15"/18"	SS6 14.0'-15.5'	4/19/23
			DARK GRAY SILTY SAND, LITTLE GRAVEL, DENSE, SATURATED SM			DRILLING STOPS 5/24/91
			... SAME AS ABOVE	8"/18"	SS7 15.5'-16.5'	4/19/26 DRILLER ENCOUNTERS BEDROCK
			TOP OF BEDROCK			6 PPM ON OVA
			MED GRAY FRACTURED DOLOMITE AND LIMESTONE, LITTLE SAND IN TOP OF SPOON	3"/18"	SS8 16.5'	50# CAUGER REFUSAL SPOON BOUNCING
			LIGHT GRAY TO DARK GRAY DOLOMITE (CHERTY), STRIATIONS OF VERY FINE BLACK SHALE, ARGILLACEOUS, JOINTED, HARD BEDDING VOID (CAVITY) ENCOUNTERED AT 20'	19/48	BOX #1	RUN #1 RQD = 39.58% (POOR)

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE | PROJECT | HOLE NO.

Hole No. MW1-DC

DRILLING LOG | DIVISION | INSTALLATION | SHEET 2 OF 9 SHEETS

1. PROJECT: HANNAH MARINE, LEMOORE, CA.
2. LOCATION (Coordinates or Station): NE CORNER, 1500' WEST OF 83 OVERPASS
3. DRILLING AGENCY: PATRICK DRILLING
4. HOLE NO. (As shown on drawing title and file number): MW1-DC
5. NAME OF DRILLER: ZWOLINSKI, COPAC
6. DIRECTION OF HOLE: ■ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 21.9'
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (MSL or MLLW)
12. MANUFACTURER'S DESIGNATION OF DRILL: CME 75
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 0.0; UNDISTURBED
14. TOTAL NUMBER CORE BOXES: 8
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 6/3/91; COMPLETED 6/11/91
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING
19. SIGNATURE OF INSPECTOR: D. BARRETT

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC. / RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
20			LT GRAY DOLOMITE, SLIGHTY ARGILLACEOUS, HORIZONTAL, DARK GRAY BEDDING PLANES	63"/63" RECOVERY 100%	BOX 1	RUN 1 21.0-26.0' RQD = 66.27
25			LT. GRAY DOLOMITE VERTICALLY FRACTURED FROM ABOUT 26-28.5'; LT. BROWN STAINING IN FRACTURES AT 27.0'. PYRITE ALONG POTENTIAL FRACTURES. ARGILLACEOUS ALONG HORIZONTAL BEDDING PLANES. LAST 4.5" IS SLIGHTLY MORE WEATHERED, DARKER GRAY, WITH MORE WHITE MOTTLING	78"/78" REC 100%	BOX 2	RUN 2 26.0-32.5' RQD = 87.82%
30						
35			LT. GRAY DOLOMITE, NO FRACTURES FROM SAMPLE A SLIGHTLY MORE WEATHERED ZONE AT AROUND 34'	104"/104"	BOX 3	RUN 3 32.5-41.0 RQD 79.57

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE | PROJECT | HOLE NO.

Hole No. MW1-DC

DRILLING LOG	DIVISION	INSTALLATION	SHEET 3 OF 4 SHEETS
1. PROJECT: HANNAH MARINE, LEMONT, IL.		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station): NE. CORNER, ~500' WEST OF 83 OVERPASS		11. DATUM FOR ELEVATION SHOWN (MSL or USC&GS)	
3. DRILLING AGENCY: PATRICK DRILLING		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number)		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED	
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE: STARTED / COMPLETED	
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE		18. TOTAL CORE RECOVERY FOR BORING	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
						RUN 3 RQD
	42		LT. GRAY DOLOMITE ARGILLACEOUS AT CORE BREAKS FRACTURED MECHANICALLY FROM ~94'-97.5' SOME THIN DARK HORIZONTAL BEDDING AT 44' A 3" PIECE WHICH IS SLIGHTLY MORE WEATHERED WITH LITTLE GREEN STAINING AT 99' FEW CHERTY NODULES SOME BROWN STAINING ON CORE FROM INSIDE OF CORING ROD SLIGHTLY MORE WEATHERED IN PARTS OF CORE AT ~99.4' CORE BECOMES SLIGHTLY VUGGY	116"/116"	BOX 4	LOST CIRCULATION COMPLETELY AT 91.5' REGAINED PARTIAL CIRCULATION AT ~92' DEPTH 91-50.5' RQD = 86.75/116" = 73.92% RUN 4 CORED ON 6/5/91 REMOVED FROM HOLE AND CORE BARREL ON 6/6/91.
	50 START 6/6/91 AT 50.5'		LT. GRAY DOLOMITE SLIGHTLY VUGGY (~10%) FRACTURED VERTICALLY FREQUENTLY FRACTURED (~70%) W/ FRACTURES A MEDIUM BROWN STAIN BEDDING PLANES ARE NOT VISIBLE. ARGILLACEOUS ALONG HORIZONTAL BREAKS WITH A LIGHT-MEDIUM GREEN CLAY. LITTLE PYRITE ALONG FRACTURES CHERTY (<5%)	63"/63"	BOX 5	AT 1ST VERTICAL FRACTURE, ~91.5'; 60"-70% LOSS OF H_2O RUN 5 52.75'/63" = 83.73 RQD RUBBLE FROM THE TOP WHICH FELL IN HOLE CONTAINED WET. RX
	55					
	56		LT. GRAY DOLOMITE WITH MOTTLED WHITE AND LT. TAN. WHITE ~25%, TAN <5%		BOX	RUN 6

Hole No. MNI-O

DRILLING LOG | DIVISION | INSTALLATION | SHEET 1 OF 4 SHEETS

1. PROJECT: SAVANNAH MARINE
2. LOCATION (Coordinates or Station): NE CORNER, ~500' WEST OF 89 OVERPASS
3. DRILLING AGENCY: PATRICK DRILLING
4. HOLE NO. (As shown on drawing title and file number)
5. NAME OF DRILLER
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (MSL or MLW)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED | UNDISTURBED
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED | COMPLETED
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			LT. GRAY TO WHITE DOLOMITE WITH SOME LIMESTONE, SLIGHTLY VUGGY, GREEN CLAY AT CORE BREAKS	43" / 43" 100% REC	BOX 6	STILL LOSING A LOT OF WATER, ABOUT 50%. RUN 7 59.5'-63' RQD = 31.75" / 43" = 73.83% RUN 7
65			LT. GRAY TO WHITE DOLOMITE TO DOLOMITIC LS. VUGGY 5-10% FRACTURED, VERTICAL LINES VISIBLE. AT ABOUT 66' CALCITE CRYSTALS FORMED ON VERTICAL FRACTURES. VERY LITTLE PYRITE THROUGHOUT, SOME LT. GREEN STAINING	119" / 119"	BOX 7	RQD 110" / 119" = 92.43% RUN 8 63'-73'
70						
				90" / 90"	BOX 8	RUN 9 RQD = 88" / 90"

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE | PROJECT | HOLE NO.

Hole No. MW15

DRILLING LOG | DIVISION | INSTALLATION | SHEET 1 OF 1 SHEETS

1. PROJECT: HANNAH MARINE CORPORATION
2. LOCATION (Coordinates or Station): NE CORNER OF SITE
3. DRILLING AGENCY: PATRICK DRILLING
4. HOLE NO. (As shown on drawing title and file number):
5. NAME OF DRILLER: ZWOLINSKI
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (GS or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL: CME 75
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED | UNDISTURBED
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 5/31/91 | COMPLETED 5/31/91
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING
19. SIGNATURE OF INSPECTOR: D. BARRETT

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			SEE LOG OF MW1-D			
	8		Wet, black-coated sandy Shale ~6"	16"/18"	SS1 8.0-9.5'	READING OF 17 PPM ON OVA. 12/14/92
	9		M. brown sandy, clayey gravel, 10", wet			OVA IN BOREHOLE
	10					
						75 PPM AT ~13.5'
						0 PPM IN BREATHING ZONE, WATER WAS OIL FLOATING ATOP IT
	15					
	20					

5' 6 7

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE | PROJECT | HOLE NO.

Hole No. MW2-S

DRILLING LOG | DIVISION | INSTALLATION | SHEET 1 OF 1 SHEETS

1. PROJECT: HANNAH MARINE CORP.
2. LOCATION (Coordinates or Station): MW2-S SOUTH OF I&M CANAL
3. DRILLING AGENCY: PATRICK DRILLING
4. HOLE NO. (As shown on drawing title and file number): MW2-S
5. NAME OF DRILLER: ZWOLINSKI
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 15.5'
8. DEPTH DRILLED INTO ROCK: 0.00
9. TOTAL DEPTH OF HOLE: 15.5'
10. SIZE AND TYPE OF BIT:
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: CME
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED: UNDISTURBED: -
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER: 4'
16. DATE HOLE: STARTED 9/31/91 COMPLETED 6/3/91
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING:
19. SIGNATURE OF INSPECTOR:

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	REC./RUN (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
			BROWN AND GRAY SILTY CLAY AND COARSE TO FINE SAND, LITTLE COARSE TO FINE GRAVEL, MOIST, MED DENSE. CLAY FILL.	14"/18"	SS1 1-2.5	2/4/6
			DRY FILL. GRAVELLY SANDY MEDIUM GRAY CLAY, MEDIUM DENSITY	15"/18"	SS2 3.5-5'	3/4/10
			DARK GRAY CLAY WITH TRACE SAND COARSE TO FINE GRAVEL. SLIGHTLY MOIST. DENSE	10"/18"	SS3 6-7.5'	3/4/31 SS3 HITS BOULDER AT ~7' 1000 PPM IN AUGER
	8.5'		MEDIUM BROWN AND TAN CLAYEY SAND. COARSE TO FINE GRAVEL. SLIGHTLY MOIST. VERY DENSE.	11"/18"	SS4 8.5-10	9/12/50 ROCK AT 9.5' OBL.
	13'		10" MEDIUM GRAY AND TAN CLAY WITH SAND AND COARSE TO FINE GRAVEL. MOIST. MEDIUM DENSE. 5" TAN SATURATED GRAVEL WITH LITTLE SAND	15"/18"	SS5 11-13.5	6/14/10
			BROWN COARSE SAND AND GRAVEL, SATURATED, LITTLE CLAY	15"/18"	SS6 14.5-16	ENVIRONMENTAL SAMPLE; CHUNK OF GRAVEL IN THE TOE OF THE SPLIT SPOON. 6/6/50 REFUSAL AT 15.5

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE | PROJECT | HOLE NO.

Hole No. MW2-D

DRILLING LOG | DIVISION | INSTALLATION | SHEET 1 OF 3 SHEETS

1. PROJECT: HANNAH MARINE CORP. LEMONT, IL
2. LOCATION (Coordinates or Station): MW2, SOUTH OF I&M CANAL
3. DRILLING AGENCY: PATRICK DRILLING
4. HOLE NO. (As shown on drawing title) AND SHEET NUMBER: MW2-D
5. NAME OF DRILLER: ZWOLINSKI
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 27.5'
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE:
10. SIZE AND TYPE OF BIT:
11. DATUM FOR ELEVATION SHOWN (GS or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: CME 75 ATV & TRUCK MOUNT
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED: UNDISTURBED:
14. TOTAL NUMBER CORE BOXES: 6
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED 6/7/91 COMPLETED 6/18/91
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: D. BARRETT

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	REC./RUN (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
20						
			SEE LOG FOR MW2-S			
25'						
			LT. GRAY TO WHITE DOLOMITE, LITTLE PYRITE THROUGHOUT CORE. SOME WHITE NODULES THROUGHOUT CORE (≈10%) SLIGHTLY ARGILLACEOUS AT HORIZONTAL BREAKS. TRACE DARK HORIZONTAL BEDDING PLANES. FRACTURES MORE EVIDENT WITH DEPTH ≥ 35'. FEW LIGHT GREEN VEINS. FOSSIL AT ≈29.5 FEET CEPHALOPOD	93" / 93" REC: 100%	BOX 1	RQD = 63"/93" = 67.74 % RUN 27.5' - 35.5'
30'						
35'			LT. GRAY DOLOMITE AT ABOUT 40.5' CORE PIECE WAS ≈16.25" LONG, WITH NO BREAKS. VERTICAL FRACTURES IN THE TOP 4 FEET OF CORE. FRACTURE LINES WERE PRESENT	132.5" / 132.5"	BOX 2	RUN 35.5' - 46' RQD = 85.75/132.5 = 87.36 LOSING ABOUT 60-70% OF WATER ON RUN 2 6" VOID AT 40'

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. MW2-D

DRILLING LOG

DIVISION

INSTALLATION

SHEET 2 OF 3 SHEETS

1. PROJECT: HANNAH MARINE CORP. LEMONT, IL
2. LOCATION (Coordinates or Station): MW2, SOUTH I&M CANAL
3. DRILLING AGENCY: PATRICK DRILLING
4. HOLE NO. (As shown on drawing title and file number): MW2-D
5. NAME OF DRILLER
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 27.5'
8. DEPTH DRILLED INTO ROCK: 27.5'
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (MSL or other)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED: UNDISTURBED:
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 6/7/91 COMPLETED
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
40			PYRITE VISIBLE IN VERTICAL FRACTURES, APPROXIMATELY 45°. ARGILLACEOUS WHERE CORE IS HORIZONTALLY BROKEN. SOME YELLOW COLORING AT ~36.5', WITH BROWN YELLOW STAINING ON FRACTURES TO ABOUT 40.5'. SOME LIGHT GREEN VEINS NEAR TOP. TRACE VUGS, SLIGHTLY ARGILLACEOUS NEAR 45', ALSO SPHERICAL CLAST (?) RESEMBLING AN OOLITE.	27.5" / 27.5"	BOX 2, 3	VOID = 6" 35.5 - 46' RUN 2
45			LT GRAY DOLOMITE TO DOLOMITIC LIMESTONE VERTICAL FRACTURES AT ABOUT 45°. PYRITE PRESENT IN FRACTURES, VUGGY. GREEN VEINS ALSO PRESENT IN SOME FRACTURES AND STAINING ON ROCK. VERY LITTLE ARGILLACEOUS AT HORIZONTAL BREAKS. VERY FEW FOSSILS	10.1" / 10.1"	BOX 3	RUN 3. 46' - 56' RQD 94" / 100' = 93.0%
50						
55					BOX 1	
			LT. TO MED. GRAY DOLOMITE VUGGY, VERTICAL FRACTURING WITH TRACE BROWN STAINING.	120" / 120"	BOX 1	RUN 4 RQD 100% DEPTH: 56' - 66'

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE

PROJECT

HOLE NO.

Hole No. MW2-D

DRILLING LOG | DIVISION | INSTALLATION | SHEET 3 OF 3 SHEETS

1. PROJECT: HANNAH MARINE, LEMONT, IL
2. LOCATION (Coordinates or Station): MW2, ~500 W OF 83 OVERPASS
3. DRILLING AGENCY: PATRICK DRILLING
4. HOLE NO. (As shown on drawing title and file number): MW2-D
5. NAME OF DRILLER:
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: ~27.5'
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE:
10. SIZE AND TYPE OF BIT:
11. DATUM FOR ELEVATION SHOWN (MSL or ...):
12. MANUFACTURER'S DESIGNATION OF DRILL: CME 75 ATV
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: UNDISTURBED: -
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED: COMPLETED:
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
60			TRACE PYRITE IN VERTICAL FRACTURES AND HORIZONTAL BREAKS, TRACE OF FOSSILS, WEATHERING IN HORIZONTAL BREAKS, SOME FRACTURES AT 45°	112" / 112" = 100%	BOX 4	RUN 4 56'-66' RQD = 61.5/110 = 59.7%
65					BOX 5	
			LT. GRAY TO MED GRAY DOLOMITE AND DOLOMITIC LIMESTONE. VERTICAL FRACTURES AT ~45° VUGGY WITH TRACE FOSSILS. TRACE PYRITE LESS THAN RUN 4. DARK GRAY BANDING. TRACE GREEN VEINS	121.5 / 121.5	BOX 5	RUN 5 66'-76.5' RQD = 92.25/121.5 = 75.92%
70						
					BOX 6	
75			LT. GRAY DOLOMITE VUGGY. TRACE GREEN VEINS, TRACE FOSSILS, VERTICAL FRACTURES AT 45° POTENTIAL FRACTURES, NO CLAY AT HORIZONTAL BREAKS	59.5' / 59.5'	BOX 6	RUN 76.5'-81' RQD = 48"/59.5 = 80.67%

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE | PROJECT | PAGE NO.

Hole No. MW3-S

DRILLING LOG

DIVISION

INSTALLATION

SHEET 1 OF 1 SHEETS

1. PROJECT: Hannah Marine Corp
2. LOCATION (Coordinates or Station): West West South and west of office
3. DRILLING AGENCY: Patrick Drilling
4. HOLE NO. (As shown on drawing title and title number): MW3-S
5. NAME OF DRILLER: Zwolinski, Ted
6. DIRECTION OF HOLE: ■ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT: Carbide Rotary Bit
11. DATUM FOR ELEVATION SHOWN (MSL or MLW): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: CME 75 ATV
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED _____ UNDISTURBED _____
14. TOTAL NUMBER CORE BOXES: 0.00
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 6/12/91 COMPLETED 6/12/91
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR: D. Barnett

Augered with 4¼

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Dark and light brown fill mtl consisting of silty clay with a trace of sand. Dark brown mtl has trace orange color. Some limestone chips.	10"/18"	SS1 1-2.5	
			7" Lt brown Fill consisting of some silty clayey sand, some coarse to fine gravel, some limestone rock chips	9"/18"	SS2 3.6-6.0	19/31/46
5'			2" Dark gray fill consisting of a sandy clear quartz gravel			
				12.5"/18"	SS3 6.0-7.5	10/19/27 water at 7'3.5"
			Medium brown saturated sandy gravel with rock fragments.		SS4 8.5-10.0	100 counts for 4"
10'						
15'						

11 Water Measured at 8ft. Bottom of well is 12.2'.

Hole No. MW3-D

DRILLING LOG | DIVISION | INSTALLATION | SHEET 1 OF 2 SHEETS

1. PROJECT: HANNAH MARINE, LEMONT, IL.
2. LOCATION (Coordinates or Station): MW3, WEST NEST
3. DRILLING AGENCY: PATRICK DRILLING
4. HOLE NO. (As shown on drawing title and file number): MW3D
5. NAME OF DRILLER: JERRY COPAK
6. DIRECTION OF HOLE: ■ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 25'
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (MSL or Other)
12. MANUFACTURER'S DESIGNATION OF DRILL: CME 75
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED | UNDISTURBED
14. TOTAL NUMBER CORE BOXES: 7
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 6/24/91 | COMPLETED 6/26/91
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: D. BARRETT

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
20						
25						
			LT. GRAY DOLOMITE NO VERTICAL FRACTURES UNTIL 9-2" FRACTURE FILLED WITH PYRITE AND IRON(?) OR COPPER (?). FRACTURE AT 45° TRACE ARGILLACEOUS HORIZONTALLY. TRACE FOSSILS VUGGY, <5% TRACE LT. GREEN STAINING, PYRITE NODULES	115" / 115"	BOX 1	6/24/91 1195 RUN 1 26'-36' RQD = 110/115 = 95.65% LOSING WATER, (CASING IS TO 23.5', BEDROCK IS AT 25', 1½' OPEN HOLE IS WHERE WE ARE LOSING WATER)
30						
35						
			LT. GRAY DOLOMITE TO DOLOMITIC LIMESTONE. VERTICAL FRACTURES, AT ABOUT 70° FROM HORIZONTAL	122" / 122"		RUN 2 36'-46' RQD 116" / 122" = 95.08%

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE | PROJECT | SCALE NO.

Hole No.

DRILLING LOG | DIVISION | INSTALLATION | SHEET 2 OF 3 SHEETS

1. PROJECT: HANNAH MARINE CORP, LEMONT, IL
2. LOCATION (Coordinates or Station): MW3, WEST WEST
3. DRILLING AGENCY: PATRICK DRILLING
4. HOLE NO. (As shown on drawing title and file number): MW3-D
5. NAME OF DRILLER: JERRY COPAK
6. DIRECTION OF HOLE: ■ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 22.5'
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL: CME 75, ATV
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED | UNDISTURBED
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED | COMPLETED
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC/RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
40			PYRITE ALONG VERTICAL FRACTURES. TRACE CLAY ALONG HORIZONTAL BREAKS, VUGGY ~10%, TRACE GREEN STAINING		BOX 2&3	RUN 2
45						
			LT. GRAY DOLOMITE. VERTICAL FRACTURES STARTING AT 47' ANGLED 45-90° FROM HORIZONTAL, SLIGHTLY ARGILLACEOUS IN HORIZONTAL FRACTURES. TRACE LT. GREEN STAINING. TRACE FOSSILS. TRACE PYRITE IN VUGS. VUGGY ~10%. TRACE PYRITE IN VERTICAL FRACTURES	125" / 125"	BOX 3&4	RUN 3 46' - 56' RQD = 114/125 = 91.20%
50						
55			LT. GRAY DOLOMITE	119.5 / 119.5	BOX 4&5	RUN 56' - 66' RQD = 117/119.5 = 97.91%

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE | PROJECT | HOLE NO.

Hole No.

DRILLING LOG | DIVISION | INSTALLATION | SHEET 7 OF 2 SHEETS

1. PROJECT: HANNAH MARLOWE, LEMONT, IL
2. LOCATION (Coordinates or Station): MW3 WEST WEST
3. DRILLING AGENCY: PATRICK DRILLING
4. HOLE NO. (As shown on drawing title and file number): MW3-D
5. NAME OF DRILLER: JERRY COPAK
6. DIRECTION OF HOLE: ■ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: ~25'
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED | UNDISTURBED
14. TOTAL NUMBER CORE BOXES: 7
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED | COMPLETED
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
60			LT. GRAY DOLOMITE TO DOLOMITIC LIMESTONE. 57'-59' SOME PINK MOTTLING APPEARS, NO VERTICAL FRACTURING, TRACE FOSSILS, TRACE VUGGY ~62' SOME CORAL FOSSILS AT HORIZONTAL BREAKS. TRACE PYRITE. TRACE ARGILLACEOUS ALONG HORIZONTAL BREAKS	119.5	BOX 4 #5	RUN 4 56'-66' RQD = 117 / 119.5
65						
70			LT. GRAY DOLOMITE TO DOLOMITIC LIMESTONE, ARGILLACEOUS ALONG HORIZONTAL BREAKS, VERTICAL FRACTURES ~70° VUGGY <5%, SOME PYRITE IN VUGS (<5%) TRACE CHERT NODULES PYRITE ALONG FRACTURES, CLAY ALONG HORIZONTAL BREAKS, COLORS VARY BETWEEN DARK BROWN, LIGHT GRAY, AND GRAY WITH A GREENISH CAST	122.5" / 122.5"	BOX 5 #6	RUN 5 66'-76' RQD = 108" / 122.5" = 88.16%
75			LT. GRAY DOLOMITE, TRACE PYRITE, WHITE CHERT, ARGILLACEOUS ALONG HORIZONTAL BREAKS, TRACE VUGGY, CLAY ALONG HOR BREAKS IS LT GRAY TO DARK BROWN	49.5 /	BOX 7	RUN 6 76'-80' RQD = 49.5 / 49.5"

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE | PROJECT | HOLE NO.

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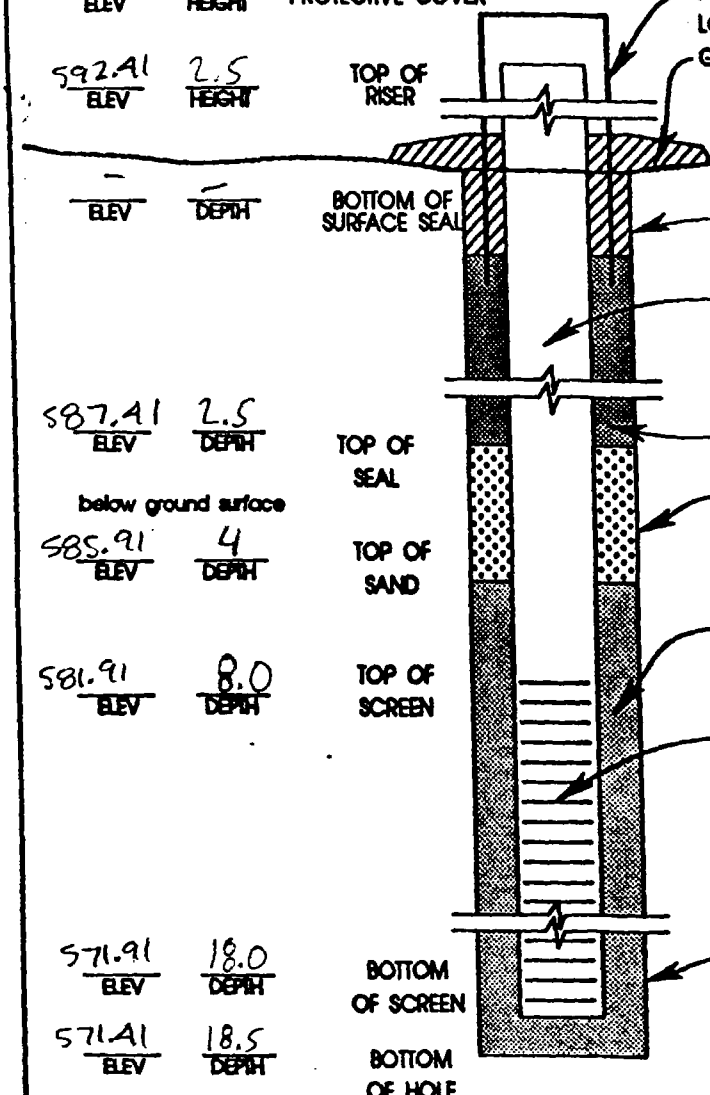
WELL NUMBER: MW1-S

MONITORING WELL AS-BUILT DIAGRAM

SITE: Hannah Marine Corp.
TDD/PAN: FOS-8810-002 / FIL0277XB
WELL DRILLING CONTRACTOR: Patrick Drilling
GEOLOGIST: D. Barrett
DATE COMPLETED: 5/31/91
LOCATION OF WELL: NE CORNER OF SITE, ~500 W OF RT. 83 OVERPASS

DATE INSTALLED: 5/31/91



ELEV	HEIGHT/DEPTH	
592.91	3.0 HEIGHT	TOP OF PROTECTIVE COVER
592.41	2.5 HEIGHT	TOP OF RISER
—	—	BOTTOM OF SURFACE SEAL
587.41	2.5 DEPTH	TOP OF SEAL
	below ground surface	
585.91	4 DEPTH	TOP OF SAND
581.91	8.0 DEPTH	TOP OF SCREEN
571.91	18.0 DEPTH	BOTTOM OF SCREEN
571.41	18.5 DEPTH	BOTTOM OF HOLE

PROTECTIVE COVER: 4"x4" stainless steel
LOCK NUMBER: 2429
GROUND ELEVATION (MSL): 589.91 FT.
SURFACE SEAL: —
RISER TYPE: SS type 304 schedule 5
DIAMETER: 2 IN.
GROUT: —
ANNULAR SEAL: Bentonite pellets
FILTER PACK: Pool Filter Sand
SCREEN DIA.: 2 IN. LENGTH: 10 FT.
TYPE: SS continuous wire wound
SLOT SIZE: 0.010 IN.
BOREHOLE DIAMETER: 6 IN.
DRILL METHOD: HOLLOW STEM AUGURING
DATE DEVELOPED: 6/26/91
METHOD OF DEVELOPEMENT: PURGE 10X VOLUME

MATERIALS USED

ITEM	QUANTITY
Pool Filter Sand for residential and commercial pools using sand filters. Highly pure quality, nontoxic chemically safe	4 bags @ ½ cubic foot / bag

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WELL NUMBER: MW1D-C

MONITORING WELL AS-BUILT DIAGRAM

SITE: Hannah Marine Corp.
TDD/PAN: FOS-8810-002 / FIL0277XB
WELL DRILLING CONTRACTOR: Patrick Drilling
GEOLOGIST: D. Barrett / P. Vojack
DATE COMPLETED: 6/12/91
LOCATION OF WELL: MW1D-C

DATE INSTALLED: 6/12/91

ELEV	HEIGHT	
—	—	TOP OF PROTECTIVE COVER
593.06	3.7	TOP OF RISER
—	—	BOTTOM OF SURFACE SEAL
—	—	TOP OF SEAL
529.36	60	TOP OF SAND
524.36	65	TOP OF SCREEN
514.36	75	BOTTOM OF SCREEN
510.86	78½	BOTTOM OF HOLE

below ground surface

PROTECTIVE COVER: 4" x 4" STAINLESS STEEL
LOCK NUMBER: 2429
GROUND ELEVATION (MSL): 589.36 FT.
SURFACE SEAL: —
RISER TYPE: Stainless steel
DIAMETER: 2 IN.
GROUT: Volclay Gold
ANNULAR SEAL: Volclay Gold
FILTER PACK: 40/60 sand
SCREEN DIA.: 2 IN. LENGTH: 10 FT.
TYPE: SS type 304, sch5
SLOT SIZE: 0.010 IN.
BOREHOLE DIAMETER: 6 IN.
DRILL METHOD: MSA-20' (6¼" ID) Coring & reaming
DATE DEVELOPED: 6/19/91
METHOD OF DEVELOPEMENT: PURGE BOX VOLUME

MATERIALS USED

ITEM	QUANTITY
Pool Filter Sand (40/60 size)	5 bags (@ 0.5 cu ft. / bag)
Volclay Gold (high % solids bentonite grout)	5 bags (14 gallons / bag)

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WELL NUMBER: MW2-S

MONITORING WELL AS-BUILT DIAGRAM

SITE: Hannah Marine Corp.
TDD/PAN: FOS-8810-002 / FIL0277XB
WELL DRILLING CONTRACTOR: Patrick Drilling
GEOLOGIST: D. Barrett
DATE COMPLETED: 6/3/91
LOCATION OF WELL: South of Old I-M Canal

DATE INSTALLED 6/3/91

ELEV	HEIGHT	
—	—	TOP OF PROTECTIVE COVER
604.33	3.18	TOP OF RISER
595.15	6ft	BOTTOM OF SURFACE SEAL
593.15	8ft	TOP OF SEAL
below ground surface		
—	8ft	TOP OF SAND
590.65	10.5	TOP OF SCREEN
585.65	15.5	BOTTOM OF SCREEN
585.65	15.5	BOTTOM OF HOLE

PROTECTIVE COVER: 4"x 4" STAINLESS STEEL
LOCK NUMBER: 2429
GROUND ELEVATION (MSL): 601.15 FT.
SURFACE SEAL: —
RISER TYPE: SS type 304 Schedule 5
DIAMETER: 2 IN.
GROUT: —
ANNULAR SEAL: BENTONITE PELLETS
FILTER PACK: Pool Filter Sand
SCREEN DIA.: 2 IN. LENGTH: 5 FT.
TYPE: SS continuos wire wound
SLOT SIZE: 0.010 IN.
BOREHOLE DIAMETER: 6 IN.
DRILL METHOD: HOLLOW STEM AUGURING
DATE DEVELOPED: 6/26/91
METHOD OF DEVELOPEMENT: PURGE 10X VOLUME

MATERIALS USED

ITEM	QUANTITY
Best Sand Corp	6 bags @ ½ cubic foot/bag 50lbs each

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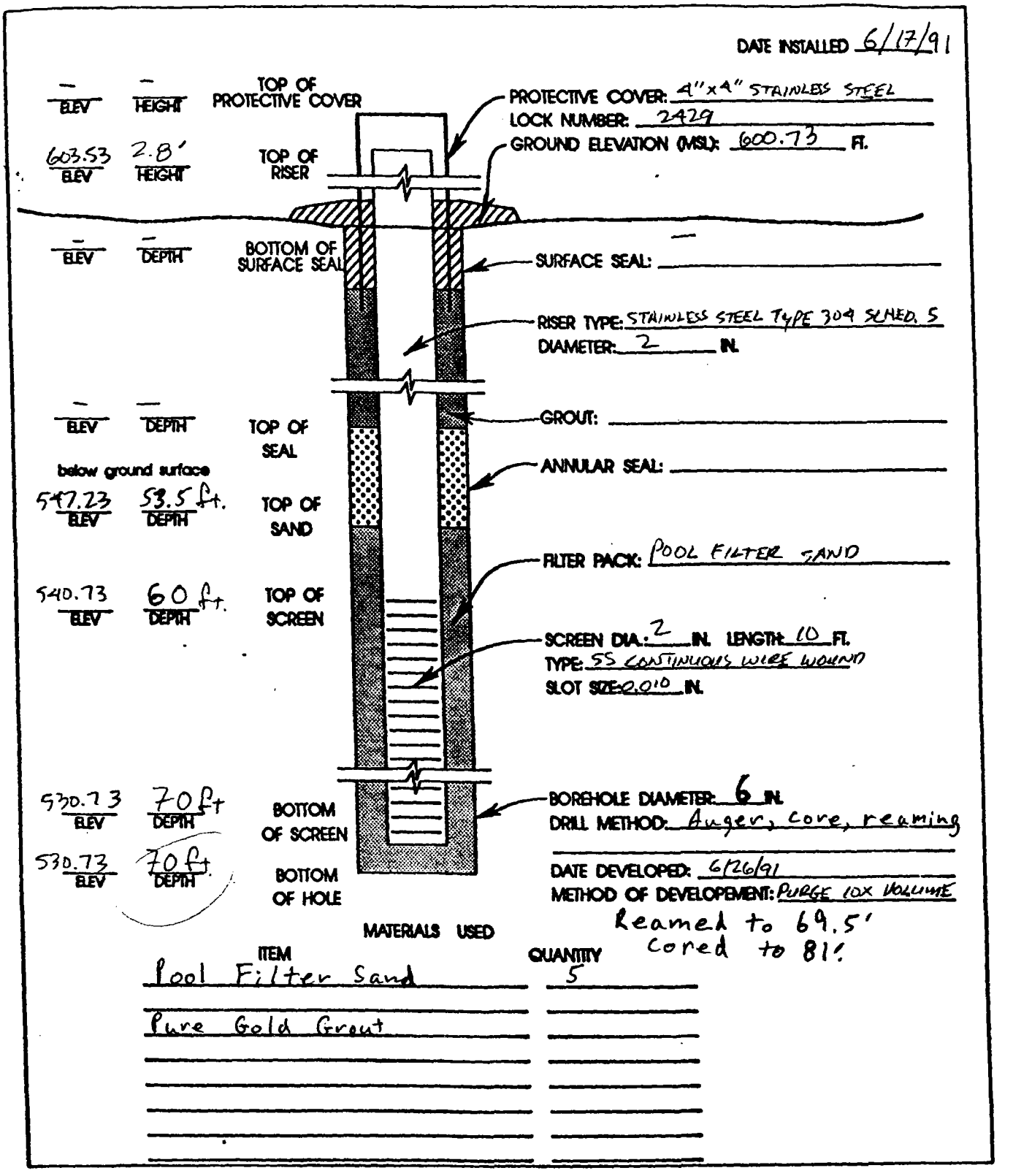
WELL NUMBER: MW2-D

MONITORING WELL AS-BUILT DIAGRAM

SITE: Hannah Marine Corp.
TDO/PAN: FOS-8810-002 / FIL0277XB
WELL DRILLING CONTRACTOR: Patrick Drilling
GEOLOGIST: D. Barrett / P. Vojack / C. Smith
DATE COMPLETED: 6/17/91
LOCATION OF WELL: West 2 South of old I-M canal



MATERIALS USED

ITEM	QUANTITY
Pool Filter Sand	5
Pure Gold Grout	

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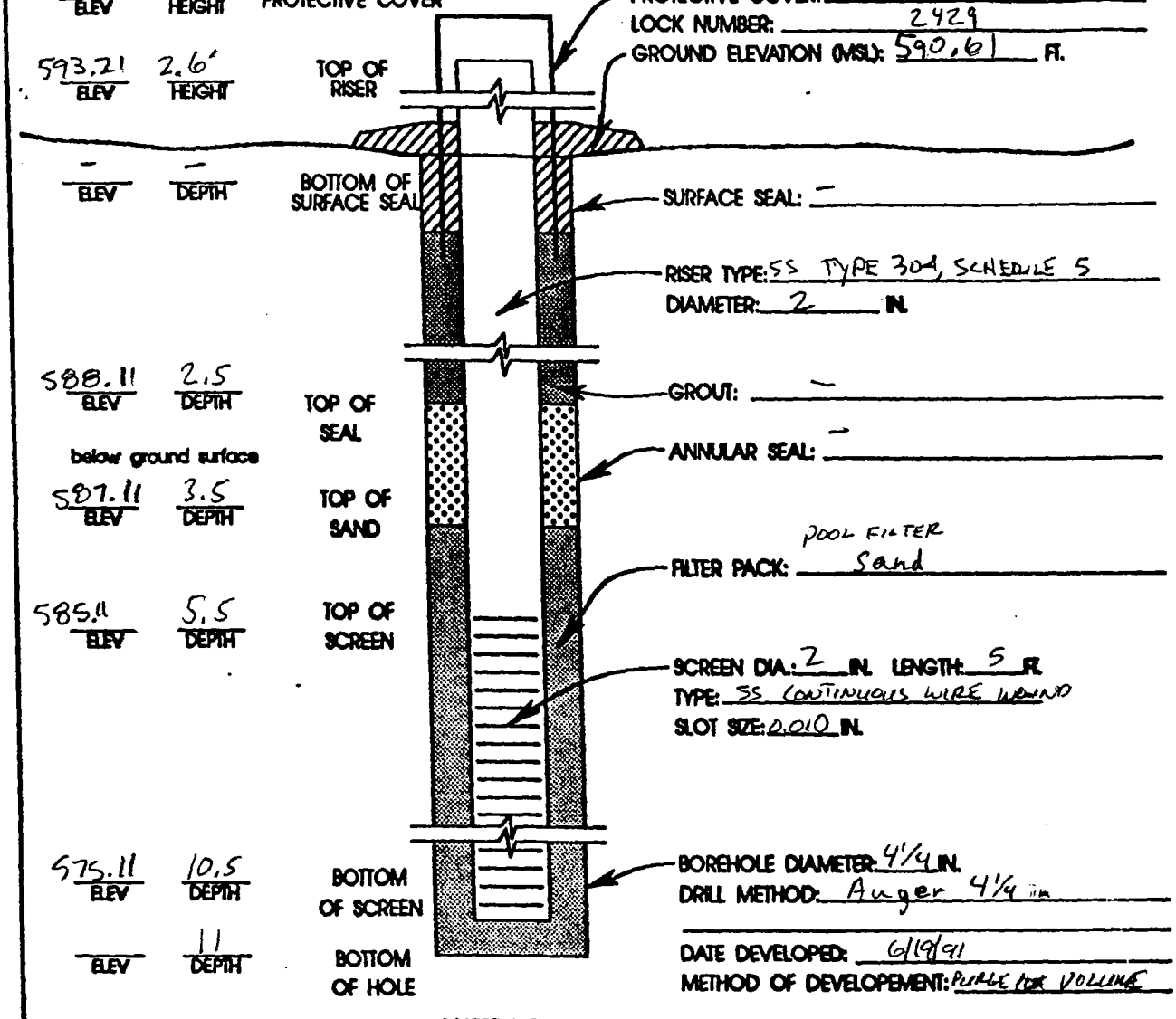
WELL NUMBER: MW3-S

MONITORING WELL AS-BUILT DIAGRAM

SITE: Hannah Marine Corp.
TDD/PAN: FOS-8810-002 / FIC0277XB
WELL DRILLING CONTRACTOR: Patrick Drilling
GEOLOGIST: D. Barrett
DATE COMPLETED: 6/12/91
LOCATION OF WELL: west nest

▼ water during drilling at 7'3.5"

DATE INSTALLED: 6/12/91



MATERIALS USED

ITEM	QUANTITY
Pool filter sand	3.5 bags
Volclay - American Colloid Company 1/4" pellets tablets	2/3 bucket (5 gallon bucket)
Portland cement from the makers of Quikrite 94lb bag	

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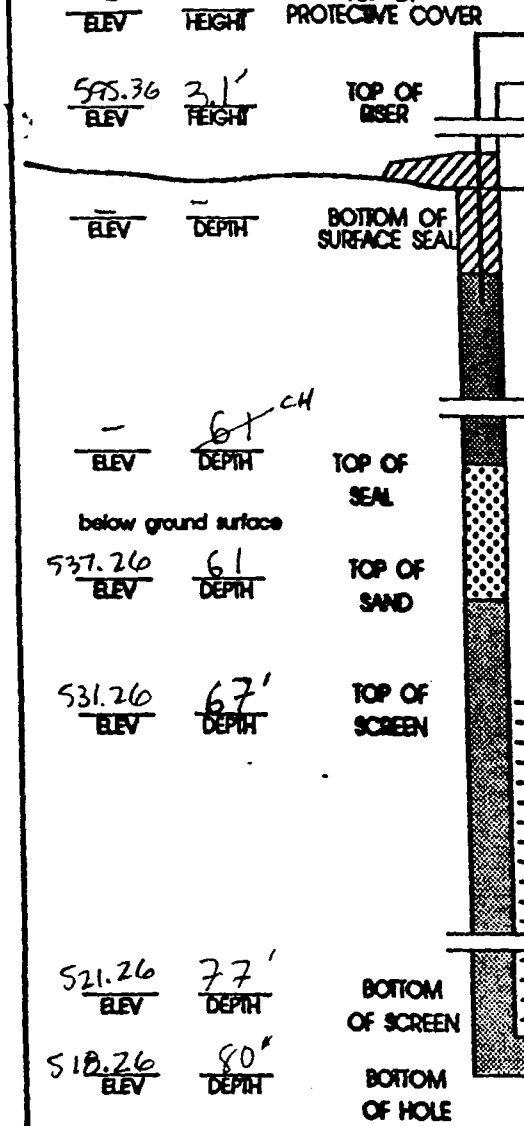
WELL NUMBER: MW3-O

MONITORING WELL AS-BUILT DIAGRAM

SITE: Hannah Marine Corp.
TDD/PAN: F05-8810-002
WELL DRILLING CONTRACTOR: Patrick Drilling
GEOLOGIST: D. Barrett
DATE COMPLETED: 6/25/91
LOCATION OF WELL: MW3-D

DATE INSTALLED 6/25/91



ELEV — HEIGHT — TOP OF PROTECTIVE COVER
595.36 ELEV 3.1' HEIGHT — TOP OF RISER
ELEV — DEPTH — BOTTOM OF SURFACE SEAL
— ELEV 61 CH DEPTH — TOP OF SEAL
below ground surface
537.26 ELEV 61 DEPTH — TOP OF SAND
531.26 ELEV 67' DEPTH — TOP OF SCREEN
521.26 ELEV 77' DEPTH — BOTTOM OF SCREEN
518.26 ELEV 80" DEPTH — BOTTOM OF HOLE

PROTECTIVE COVER:
LOCK NUMBER: 2429
GROUND ELEVATION (MSL): 592.26 FT.
SURFACE SEAL:
RISER TYPE: SS TYPE 304 SCHEDULE 5
DIAMETER: 2 IN.
GROUT: Pure Gold Grout
ANNULAR SEAL: Pure Gold Grout
FILTER PACK: Pool Filter Sand
SCREEN DIA.: 2 IN. LENGTH: 10 FT.
TYPE: SS CONTINUOUS WIRE WOUND
SLOT SIZE: 0.010 IN.
BOREHOLE DIAMETER: 4 1/4 IN.
DRILL METHOD: auger, core, reaming
DATE DEVELOPED: 6/26/91
METHOD OF DEVELOPEMENT: PURGE 10X VOLUME

MATERIALS USED

ITEM	QUANTITY
Pool filter sand 50 lbs 1/2 cubic ft	6 1/2 bags
Pure gold grout L0810900 50 lb. bag	4 bags
Valclay medium chips	1/3 of 50 lb. bag

MONITORING WELL DEVELOPEMENT LOG

MW1-S

Site Name HANNAH MARINE CORP.
Location LEMONT, IL
TDD F-05-8810-002
PAN FIL0277XBR
Personnel LOPAK, WARD, BARRETT, TUREK

Well Number MW1S
Date Development Began 6/19/91
Date Development Completed 6/19/91
TOIC Elevation 592.41
Depth of Well 18.5'

Before Development Water Level 8.4 & 20°C 17.8.
After Development Water Level 8.95

8.4
removed 30 gallons

Date	Time	Test No.	Gal. Purged	Cum. Purged	Temp °C	Cond. (ms/cm)	pH	Turbidity	Comments
6/19/91	1007	1	1	1	14°C 77.5F	2.67x 1000	6.95	very turd mud-dark gray	
6/19/91	1125	2	12.5	12.5	17°C 75.2	2.96x 1000	7.25	turbid lt-med gray	
6/19/91	1153	3	25	25	18C 71.2	3.10x 1000	7.02	turbid lt gray	
6/19/91	1345	4	30	30	70.5F	2.95x 1000	7.00		

Method of Developement Purge well of 10x standing volume with Bramard Killman Pump

Comments About 4 gallons waiting in to recharge and 30 gallons water became very dark gray again

1/11

MONITORING WELL DEVELOPEMENT LOG

Site Name Camp Lejeune Marine Corp — Well Number MW-D

Location [illegible] Island, NC — Date Development Began 6/19/91

TDD [illegible] 88810-002 — Date Development Completed 6/19/91

PAN [illegible] — TOIC Elevation 593.06

Personnel [illegible], Joe Ward, Barnett, Turek — Depth of Well 78.5'

Before Development Water Level 9.8 FT Began 8:35 Purged 130 gallon

After Development Water Level 10.25

Date	Time	Test No.	Gal. Purged	Cum. Purged	Temp °C	Cond. (ms/cm)	pH	Turbidity	Comments
Thursday 6/19/91	0844	1	17	17	15°C 65.8F	1802	7.25	slightly	
6/19/91	1130	2	40	40	71.7 15°C	1732	7.05	very slightly	
6/19/91	1340	3	100	100	17°C 79.6°F	1760	6.89		

Method of Developement Purge well of 10x standing volume with a Brassard Kit pump

Comments

24.5 Distilled H2O

MONITORING WELL DEVELOPEMENT LOG

Site Name Lejeune Marine Corp
Location Loc. # 12
OD FA-8820-002
PAN CTO277XB
Personnel Garrett, Copal (JHF), Turek

Well Number MW2-5
Date Development Began 3/26/91
Date Development Completed 6/26/91
TOIC Elevation 604.33
Depth of Well 15.5'

Before Development Water Level _____
After Development Water Level _____

Date	Time	Test No.	Gal. Purged	Cum. Purged	Temp °C	Cond. (ms/cm)	pH	Turbidity	Comments
						DATA			
						NOT			
						RECORDED			

Method of Developement Purge well of 10x standing volume with Brainard-Kilman Pump

Comments Depth of well from top of ~~of~~ riser pipe is ~~16.0~~ 16'. Depth to water was 16.95'.

MONITORING WELL DEVELOPEMENT LOG

Site Name Navrah Marine Corp
Location Lemont, IL
DD FOS-8810-002
PAN FIL027718
Personnel Barrett, Copak(Jeff), Turek

Well Number MW2-D
Date Development Began 6/26/91
Date Development Completed 6/26/91
TOIC Elevation 603.53'
Depth of Well Cored to 81'
reamed to 69.5'

Before Development Water Level 17.825
After Development Water Level

Date	Time	Test No.	Gal. Purged	Cum. Purged	Temp °C	Cond. (ms/cm)	pH	Turbidity	Comments
6/26/91	1412	1	10	10	73°F 17.5°C	.187X 1000	7.34	NONE	
6/26/91	1438	2	25	25	68.5 18°C	10.80K 100	7.47	NONE	Slow recharge
6/26/91	1523	3	40	40	69	14.66X 100	7.50	NONE	

Method of Developement Purge 10X standing water volume (gallons) with Brainard-Killman Pump

Comments Depth of well 69.5'

leave 1630

MONITORING WELL DEVELOPEMENT LOG

Site Name Hannah Marine Corp.
Location Lemont, IL
DD F-05-8810-002
PAN FIL0277XB
Personnel Barrett, J. Copcik, Turek

Well Number MW3-S
Date Development Began 6/19/91
Date Development Completed 6/19/91
TOIC Elevation 593.21
Depth of Well 12 FT from top of filter pipe - 11.0'

Before Development Water Level 10.75
After Development Water Level 10.93

1.25 x 1.7 = 2.125

Date	Time	Test No.	Gal. Purged	Cum. Purged	Temp °C	Cond. (ms/cm)	pH	Turbidity	Comments
6/19/91	3:30	1	1/2	1/2	19°C 80°C	1.75 1000	6.95	Turbid	
6/19/91	3:37	2	1 1/2	1 1/2	76° 22°C	18.63+ 100	6.93	Turbid	
6/19/91	15:54	3	2.5	2.5	72°	2.04+ 1000	6.98	Turbid	

Method of Developement Purge 10x standing water volume with Brainard Killman Pump

Comments

MONITORING WELL DEVELOPEMENT LOG

19-6.3 = 12.7

Site Name Hannah Marine Corp

Location Lemont, IL

OD

PAN FIL 0277xB

Personnel Barrett, Turek, Jeff Copek

Begin Development at 9:15 9:45 End at

Before Development Water Level 12.7 feet

After Development Water Level 5.9 feet

Well Number MW3-D

Date Development Began 6/26/91

Date Development Completed 6/26/91

TOIC Elevation 595.36

Depth of Well 77'

64.3 = 1 gallon water

64.3 x 7 = 10.93 x 10 = 109.3

Date	Time	Test No.	Gal. Purged	Cum. Purged	Temp °C	Cond. (ms/cm)	pH	Turbidity	Comments
6/26/91	923	1	15	15	69.9	15.65 x 100	7.40		
6/26/91	930	2	25	40	16°C 70.5°F	1.83 x 1000	7.53	cloudy	
6/26/91	937	3	20	60	16°C 68°F	1.88 x 1000	7.42	cloudy	
6/26/91	940	4	10	70	15°C 64°F	2.02 x 1000	7.30	cloudy	
6/26/91	1013	5	20	90	16°C 69°F	2.04x 1000	7.40	cloudy	
6/26/91	1020	6	10	100	15°C 66.7°F	2.07 x 1000	7.23	cloudy	
6/26/91	1026	7	10	110	65.4°F 16°C	2.14 x 1000	7.15	cloudy	

Method of Developement Purge 10X standing water volume with the Brainard Kilman Pump

Comments We purged 130 gallons

APPENDIX D

U.S. EPA TARGET COMPOUND LIST AND TARGET ANALYTE LIST QUANTITATION/DETECTION LIMITS

Contract Laboratory Program
Target Compound List
Quantitation Limits

COMPOUND	CAS #	WATER	SOIL SEDIMENT SLUDGE
Chloromethane	74-87-3	10 ug/L	10 ug/Kg
Bromomethane	74-83-9	10	10
Vinyl chloride	75-01-4	10	10
Chloroethane	75-00-3	10	10
Methylene chloride	75-09-2	5	5
Acetone	67-64-1	10	5
Carbon disulfide	75-15-0	5	5
1,1-dichloroethene	75-35-4	5	5
1,1-dichloroethane	75-34-3	5	5
1,2-dichloroethene (total)	540-59-0	5	5
Chloroform	67-66-3	5	5
1,2-dichloroethane	107-06-2	5	5
2-butanone (MEK)	78-93-3	10	10
1,1,1-trichloroethane	71-55-6	5	5
Carbon tetrachloride	56-23-5	5	5
Vinyl acetate	108-05-4	10	10
Bromodichloromethane	75-27-4	5	5
1,2-dichloropropane	78-87-5	5	5
cis-1,3-dichloropropene	10061-01-5	5	5
Trichloroethene	79-01-6	5	5
Dibromochloromethane	124-48-1	5	5
1,1,2-trichloroethane	79-00-5	5	5
Benzene	71-43-2	5	5
Trans-1,3-dichloropropene	10061-02-6	5	5
Bromoform	75-25-2	5	5
4-Methyl-2-pentanone	108-10-1	10	10
2-Hexanone	591-78-6	10	10
Tetrachloroethene	127-18-4	5	5
Tolene	108-88-3	5	5
1,1,2,2-tetrachloroethane	79-34-5	5	5
Chlorobenzene	108-90-7	5	5
Ethyl benzene	100-41-4	5	5
Styrene	100-42-5	5	5
Xylenes (total)	1330-20-7	5	5

Table A
Contract Laboratory Program
Target Compound List
Semivolatiles Quantitation Limits

COMPOUND	CAS #	WATER	SOIL SEDIMENT SLUDGE
Phenol	108-95-2	10 ug/L	330 ug/Kg
bis(2-Chloroethyl) ether	111-44-4	10	330
2-Chlorophenol	95-57-8	10	330
1,3-Dichlorobenzene	541-73-1	10	330
1,4-Dichlorobenzene	106-46-7	10	330
Benzyl Alcohol	100-51-6	10	330
1,2-Dichlorobenzene	95-50-1	10	330
2-Methylphenol	95-48-7	10	330
bis(2-Chloroisopropyl) ether	108-60-1	10	330
4-Methylphenol	106-44-5	10	330
N-Nitroso-di-n-dipropylamine	621-64-7	10	330
Hexachloroethane	67-72-1	10	330
Nitrobenzene	98-95-3	10	330
Isophorone	78-59-1	10	330
2-Nitrophenol	88-75-5	10	330
2,4-Dimethylphenol	105-67-9	10	330
Benzoic Acid	65-85-0	50	1600
bis(2-Chloroethoxy) methane	111-91-1	10	330
2,4-Dichlorophenol	120-83-2	10	330
1,2,4-Trichlorobenzene	120-82-1	10	330
Naphthalene	91-20-3	10	330
4-Chloroaniline	106-47-8	10	330
Hexachlorobutadiene	87-68-3	10	300
4-Chloro-3-methylphenol	59-50-7	10	330
2-Methylnaphthalene	91-57-6	10	330
Hexachlorocyclopentadiene	77-47-4	10	330
2,4,6-Trichlorophenol	88-06-2	10	330
2,4,5-Trichlorophenol	95-95-4	50	1600
2-Chloronaphthalene	91-58-7	10	330
2-Nitroaniline	88-74-4	50	1600
Dimethylphthalate	131-11-3	10	330
Acenaphthylene	208-96-8	10	330
2,6-Dinitrotoluene	606-20-2	10	330
3-Nitroaniline	99-09-2	50	1600
Acenaphthene	83-32-9	10	330
2,4-Dinitrophenol	51-28-5	50	1600
4-Nitrophenol	100-02-7	50	1600
Dibenzofuran	132-64-9	10	330
2,4-Dinitrotoluene	121-14-2	10	330
Diethylphthalate	84-66-2	10	330
4-Chlorophenyl-phenyl ether	7005-72-3	10	330

Table A
Contract Laboratory Program
Target Compound List
Semivolatiles Quantitation Limits

COMPOUND	CAS #	WATER	SOIL SLUDGE SEDIMENT
Fluorene	86-73-7	10 ug/L	330 ug/Kg
4-Nitroaniline	100-01-6	50	1600
4,6-Dinitro-2-methylphenol	534-52-1	50	1600
N-nitrosodiphenylamine	86-30-6	10	330
4-Bromophenyl-phenylether	101-55-3	10	330
Hexachlorobenzene	118-74-1	10	330
Pentachlorophenol	87-86-5	50	1600
Phenanthrene	85-01-8	10	330
Anthracene	120-12-7	10	330
Di-n-butylphthalate	84-74-2	10	330
Fluoranthene	206-44-0	10	330
Pyrene	129-00-0	10	330
Butylbenzylphthalate	85-68-7	10	330
3,3'-Dichlorobenzidine	91-94-1	20	660
Benzo(a)anthracene	56-55-3	10	330
Chrysene	218-01-9	10	330
bis(2-Ethylhexyl)phthalate	117-81-7	10	330
Di-n-octylphthalate	117-84-0	10	330
Benzo(b)fluoranthene	205-99-2	10	330
Benzo(k)fluoranthene	207-08-9	10	330
Benzo(a)pyrene	50-32-8	10	330
Indeno(1,2,3-cd)pyrene	193-39-5	10	330
Dibenz(a,h)anthracene	53-70-3	10	330
Benzo(g,h,i)perylene	191-24-2	10	330

Table A
Contract Laboratory Program
Target Compound List
Pesticide and PCB Quantitation Limits

COMPOUND	CAS #	WATER	SOIL SEDIMENT SLUDGE
alpha-BHC	319-84-6	0.05 ug/L	8 ug/Kg
beta-BHC	319-85-7	0.05	8
delta-BHC	319-86-8	0.05	8
gamma-BHC (Lindane)	58-89-9	0.05	8
Heptachlor	76-44-8	0.05	8
Aldrin	309-00-2	0.05	8
Heptachlor epoxide	1024-57-3	0.05	8
Endosulfan I	959-98-8	0.05	8
Dieldrin	60-57-1	0.10	16
4,4'-DDE	72-55-9	0.10	16
Endrin	72-20-8	0.10	16
Endosulfan II	33213-65-9	0.10	16
4,4'-DDD	72-54-8	0.10	16
Endosulfan sulfate	1031-07-8	0.10	16
4,4'-DDT	50-29-3	0.10	16
Methoxychlor (Mariate)	72-43-5	0.5	80
Endrin ketone	53494-70-5	0.10	16
alpha-Chlordane	5103-71-9	0.5	80
gamma-chlordane	5103-74-2	0.5	80
Toxaphene	8001-35-2	1.0	160
AROCLOR-1016	12674-11-2	0.5	80
AROCLOR-1221	11104-28-2	0.5	80
AROCLOR-1232	11141-16-5	0.5	80
AROCLOR-1242	53469-21-9	0.5	80
AROCLOR-1248	12672-29-6	0.5	80
AROCLOR-1254	11097-69-1	1.0	160
AROCLOR-1260	11096-82-5	1.0	160

TABLE A (Cont.)
CONTRACT LABORATORY PROGRAM
HAZARDOUS SUBSTANCE LIST (HSL)
INORGANIC DETECTION LIMITS

COMPOUND	PROCEDURE	DETECTION LIMITS	
		WATER	SOIL SEDIMENT SLUDGE
ALUMINUM	ICP	200 ug/L	40 mg/KG
ANTIMONY	FURNACE	60	2.4
ARSENIC	FURNACE	10	2
BARIUM	ICP	200	40
BERYLLIUM	ICP	5	1
CADMIUM	ICP	5	1
CALCIUM	ICP	5000	1000
CHROMIUM	ICP	10	2
COBALT	ICP	50	10
COPPER	ICP	25	5
IRON	ICP	100	20
LEAD	FURNACE	5	1
MAGNESIUM	ICP	5000	1000
MANGANESE	ICP	15	3
MERCURY	COLD VAPOR	0.2	0.008
NICKEL	ICP	40	8
POTASSIUM	ICP	5000	1000
SELENIUM	FURNACE	5	1
SILVER	ICP	10	2
SODIUM	ICP	5000	1000
THALLIUM	FURNACE	10	2
TIN	ICP	40	8
VANADIUM	ICP	50	10
ZINC	ICP	20	4
CYANIDE	COLOR	10	2

APPENDIX E

SOIL AND GROUNDWATER ANALYTICAL RESULTS

APPENDIX F

WELL LOGS OF THE AREA OF THE SITE

EQUESTED AND MAIL ORIGINAL TO STATE
SUMER HE'' TH PROTEC''ION, 535 WEST
51. DO NO ZTACH GE\ GICAL/WATER
: PROPER WELL LOCATION.

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Kerr Trailer Well No. ____
Address 15700 S. La Grange Rd Orland Park
Driller Phil Knuesen License No. 102-84
11. Permit No. 116238 Date 12-20-84
12. Water from Rock (Formation) 13. County DuPage
at depth 5 to 150 ft. Sec. 12 ¼
14. Screen: Diam. ____ in. Twp. 37 N
Length: ____ ft. Slot ____ Rge. 11E
Elev. ____

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
5'	Black 16lb	0	40

SHOW LOCATION IN SECTION PLAT
NW ¼ of SW

16. Size Hole below casing: 4 3/8 in.
17. Static level 5 ft. below casing top which is 1 ft. above ground level. Pumping level 60 ft. when pumping at 150 gpm for 4 hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
Soil	0	5
Sand Gravel	5	27
Rock	22	150

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED Phil Knuesen DATE 2-7-85

Date	Loc.	Test	D	P	W	C	

12 37N 11E

TO DRILLERS

EQUESTED AND MAIL ORIGINAL TO STATE
SUMER HE TH PROTE ON, 535 WEST
61. DO NOT DETACH GEOLOGICAL/WATER
: PROPER WELL LOCATION.

GEOLOGICAL AND WATER SURVEYS WELL RECORD

(Knollwood Treatment Plant)

10. Property owner COUNTY OF DU PAGE Well No. ____
Address 421 N. County Farm Rd., Wheaton, IL
Driller GEORGE E. GAFFKE License No. 102-234
11. Permit No. 110149 Date 10/25/83
12. Water from Limestone (Formation) 13. County DuPage
at depth 26 to 145 ft. Sec. 12 ¼
14. Screen: Diam. ____ in. Twp. 37N
Length: ____ ft. Slot ____ Rge. 11E
Elev. ____

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
14	Steel	+1½	32

SHOW LOCATION IN SECTION PLAT
50'N 275'E
SW ¼ NW ¼ SW ¼
Inside Wall

16. Size Hole below casing: 12¼ in.
17. Static level 5 ft. below casing top which is 1½ ft. above ground level. Pumping level ____ ft. when pumping at ____ gpm for ____ hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
Brown Clay	10	10
Broken Rock & Gravel	16	26
Limestone	119	145

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED ____ DATE 3/29/84

Date			D	P	W	C	

12 37N 11E

$ TO DRILLERS

QUESTED A' IL ORIGI . TO STATE DE-
16, STATE I BUILD SPRINGFIELD,
CAL / WATER .. RVEYS SEC...N. BE SURE TO

GEOLOGICAL AND WATER SURVEYS WELL RECORD

Completed 7-13-72

10. Property owner Selva Buiel Well No. ______
Address Lot 13 Space Valley Sub
Driller K K Webb License No. 92-532
11. Permit No. 18766 Date 7/11
12. Water from Limestone (Formation) 13. County DuPage
at depth 60 to 180 ft.
Sec. 12
14. Screen: Diam. ______ in.
Twp. 37N
Length: ______ ft. Slot ______
Rge. 11E
Elev. ______

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
5	Blk 15	0	132

SHOW LOCATION IN SECTION PLAT
Lot 13 Space Valley S.D. in NW (permit)

16. Size Hole below casing: 5 in.
17. Static level 62 ft. below casing top which is 2 ft. above ground level. Pumping level 120 ft. when pumping at ______ gpm for ______ hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
Overburden	132	132
Rock formation	48	180

COUNTY No. 2949

(CON... ON SEPARATE SHEET IF NECESSARY)

S...ED Chris Kuiper DATE 8/29

DUPAGE ... -37 ... E

QUESTED ...
16, STATE OFFICE BUILDING, SPRINGFIELD,
CAL / WATER SURVEYS SECTION. BE SURE TO

GEOLOGICAL AND WATER SURVEYS WELL RECORD

Completed 8-22-74

10. Property owner Jim Adcook Well No. ______
Address 11 S 165 Madison, Hinsdale, Illinois
Driller DuPage Pump, Inc. License No. 92-147
11. Permit No. 31553 Date July 25, 1974
12. Water from Limestone (Formation) 13. County DuPage
at depth ______ to ______ ft.
Sec. 12
14. Screen: Diam. ______ in.
Twp. 37N
Length: ______ ft. Slot ______
Rge. 11E
Elev. ______

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
6	Steel 19.45	0	52'

SHOW LOCATION IN SECTION PLAT
Lot # 5 Des Plaines Industries # 1,
NW NW NW(permit)

16. Size Hole below casing: 6 in.
17. Static level ______ ft. below casing top which is 8 ft. above ground level. Pumping level 12 ft. when pumping at 50 gpm for 2 hours. Submersible pump set at 84'

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
Drift	52'	52'
Limestone	68'	120'

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED [signature] DATE 8-22-74

COUNTY No. 23104

DUPA...

12-37N-11E

1. DO NOT DETACH GEOLOGICAL WATER ... PROPER WELL LOCATION.

GEOLOGICAL AND WATER SURVEYS WELL RECORD

Completed 5-31-77

10. Property owner Frakes Farms Well No. ____
Address Box 59 Wayne Springs
Driller Bothwell Drilling License No. 102-214
11. Permit No. 57965 Date 3-18-77
12. Water from Limestone Formation 13. County DuPage
at depth 10 to 100 ft.
14. Screen: Diam. ____ In.
Length: ____ ft. Slot ____
Sec. 11
Twp. 37N
Rge. 11E
Elev. ____

SHOW LOCATION IN SECTION PLAT

Lot #41, Assessment Div. Subd., NE (permit)

15. Casing and Liner Pipe

Diam. (in)	Kind and Weight	From (Ft.)	To (Ft.)
5	Plastic Pipe	0	40

16. Size Hole below casing: 5 in.
17. Static level 10 ft. below casing top which is 2 ft. above ground level. Pumping level 63 ft. when pumping at ____ gpm for ____ hours. Sub. pump set at 63'.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
Overburden	40	40
Limestone	60	100

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED Ralph Anderson DATE 6/6/77

COUNTY No. 25076

1

DO NOT DETACH GEOLOGICAL/WATER PROPER WELL LOCATION.

GEOLOGICAL AND WATER SURVEYS WELL RECORD

Completed October 18, 1977

10. Property owner Chester Gregory Well No. ____
Address 44W235 Rt. 64 Hinsdale
Driller DuPage Pump License No. 102-207
11. Permit No. 68702 Date 10-28-77
12. Water from Limestone Formation 13. County DUPAGE
at depth ____ to ____ ft.
14. Screen: Diam. ____ in.
Length: ____ ft. Slot ____
Sec. 11
Twp. 37N
Rge. 11E
Elev. ____

SHOW LOCATION IN SECTION PLAT

Lot 39 County Clerk Assesment Div. NE SW NE 8 (permit)

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
5	Steel 14.98	0	80

16. Size Hole below casing: 5 in.
17. Static level 5 ft. below casing top which is ____ ft. above ground level. Pumping level 40 ft. when pumping at 10 gpm for 2 hours. Sub. pump set at 100'

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
Drift	80	80
Limestone	50	130

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED Ralph Wellendag DATE 10/21/77

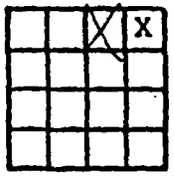
COUNTY No. 25234

DUPAGE 7N-11E

UMER HEALTH PROTECTION, 535 WEST
I. DO NOT DETACH GEOLOGICAL/WATER
PROPER Y . LOCATIC

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Don Schultz Well No. 1
Address Lot #6; Spring Acres Sub.
Driller Charles Fykes License No. 23
11. Permit No. 114628 Date 9-7-84
12. Water from Limestone (Formation) 13. County DuPage
at depth 128 to 185 ft.
14. Screen: Diam. ____ in.
Length: ____ ft. Slot ____
Sec. 11
Twp. 37N
Rge. 11E
Elev. ____



15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
5"	A-53 15 lbs.	0	132

SHOW LOCATION IN SECTION PLAT
Lot #6 on Spring Acres Located on NW NE

16. Size Hole below casing: 5 in.
17. Static level 100 ft. below casing top which is +1 ft. above ground level. Pumping level 120 ft. when pumping at 10 gpm for 1 hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
Clay	50'	50'
Gravel	20'	70'
Clay	10'	80'
Gravel	48'	128'
Limestone	57'	185'

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

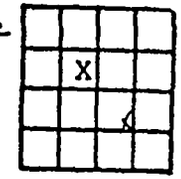
SIGNED Charles Fykes DATE Sept. 19, 1984

11 37N 11E

ISUMER HEALTH PROTECTION, 535 WEST
61. DO NOT DETACH GEOLOGICAL/WATER
E PROPER .L LOCATI

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Corwin Lenz Well No. 1
Address Jerns St., Lemont, IL
Driller Charles Fykes License No. 102-23
11. Permit No. 120250 Date 9-13-85
12. Water from Limestone (Formation) 13. County DuPage
at depth 12 to 125 ft.
14. Screen: Diam. ____ in.
Length: ____ ft. Slot ____
Sec. 11 3c
Twp. 37N
Rge. 11E
Elev. ____



15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
5"	A-53 15 lbs.	0	42

SHOW LOCATION IN SECTION PLAT
SE NW SE

16. Size Hole below casing: 5 in.
17. Static level 15 ft. below casing top which is +1 ft. above ground level. Pumping level 40 ft. when pumping at 12 gpm for 1 hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
Gravel	12'	12'
Limestone	113'	125'

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED Charles Fykes DATE Sept. 16, 1985

11 37N 11E

REQUESTED AND MAIL ORIGINAL TO STATE
ONSUMER HEALTH PROTECTION, 535 WEST
2761. DO N DETACH GE OGICAL/WATER
DE PROPE. ELL LOCAT .

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner DuPage Co. Forest Preserve Well No. 83-2
Address Box 2339 - Glen Ellyn, Ill.
Driller Del Grand License No. 102-2813
11. Permit No. 105988 Date Jan. 7, 1983
12. Water from Rock (Formation) 13. County DuPage
at depth ____ to 200 ft. Sec. 11.8
14. Screen: Diam. ____ in. Twp. 37N
Length: ____ ft. Slot ____ Rge. 11E
Elev. ____

SHOW LOCATION IN SECTION PLAT
NW NW SW

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
5"	#19 Galvanized	0	75

16. Size Hole below casing: 4 3/4 in.
17. Static level 40 ft. below casing top which is 1 ft. above ground level. Pumping level 60 ft. when pumping at 9 gpm for 4 hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
Top Soil	0	2
Clay	2	7
Sand Gravel	7	38
Clay	38	62
Sand Gravel	62	75
Rock	75	200

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED [signature] DATE Jan. 27, 1983

11.8 37N

REQUESTED AND MAIL ORIGINAL TO STATE
NSUMER HE LTH PROTECTION, 535 WEST
761. DO NO ETACH GE OGICAL/WATER
E PROPER WELL LOCATION.

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Emilie Rannin Well No. 1
Address 11 S 010 Jackson St., Hinsdale, Il.
Driller Charles Fykes License No. 23
11. Permit No. 101400 Date 9-17-81
12. Water from Limestone (Formation) 13. County DuPage
at depth 140 to 185 ft. Sec. 11 4/4
14. Screen: Diam. ____ in. Twp. 37N
Length: ____ ft. Slot ____ Rge. 11E
Elev. ____

SHOW LOCATION IN SECTION PLAT
NW SW NE

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
5"	A-53 15 lbs.	0	140'

16. Size Hole below casing: 5 in.
17. Static level 120 ft. below casing top which is +1 ft. above ground level. Pumping level 140 ft. when pumping at 10 gpm for 1 hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
Top Soil	2'	2'
Clay	123'	125'
Clay & Gravel	15'	140'
Limestone	45'	185'

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED Charles Fykes DATE 2-14-83

11-37N-11E